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THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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Changes in Periodontal Membrane—*Orban*
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BUREAU OF CHEMISTRY
Ora-Noid

DENTAL HEALTH EDUCATION
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J. H. BALDWIN, D. D. S., F. A. C. D.
(1861-1929)

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Original Communications

INTERCEPTING CERTAIN TYPES OF MALOCCLUSION*

By R. C. WILLETT, D.M.D., Peoria, Ill.

FROM the very beginning of the practice of orthodontia, through its rapidly progressive stages of acquired knowledge and formulated technic, down to a comparatively recent period of attainment, the prevailing idea was that such practice pertained essentially to the mechanical correction of teeth already malposed, rather than to the prevention or interception of abnormal tendencies which, if permitted to progress, would eventually result in gross malformation of the dental arches, and malocclusion of the teeth.

Today, the point of view of the general practitioner in dentistry, and that of the orthodontist, is changing. Owing to the publication in general and specific literature on the close observations and intensive research work of many orthodontists, we have entered on a new era. We are taking a broader view of our professional opportunities and responsibilities, while the laity have become somewhat informed in regard to facts concerning oral causes and effects that only a few years ago were of special knowledge to the dentist or orthodontist only. A natural consequence is that the laity are beginning to realize the importance of having professional attention given to the child's mouth and teeth during the formative growth period of its life. But another result of such limited knowledge of the importance of perfect arch formation and occlusion of teeth is that the dentist and the orthodontist of today are appealed to by parents even before attention has been called to specific and fundamental conditions of abnormality through professional consultation and advice.

If the foregoing deductions are correct, as from personal contacts with fellow practitioners in many localities I

*Read before the Section on Orthodontia and Periodontia at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 22, 1928.

believe them to be, this change has made imperative the duty of both the dentist and the orthodontist to embrace every opportunity of acquiring a practical knowledge of methods through which the interception of malocclusion can be accomplished. As practitioners in our respective branches of the profession, we should be in a sorry plight if the persons to be served were able to make demands for services beyond either our experience or our ability to perform. Especially embarrassing would be the situation if such service was well within the possible scope of what we were professing to practice.

Now, any comprehensive considera-

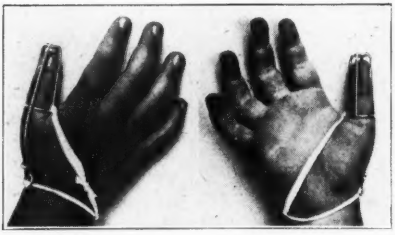

Fig. 1.—Jackson sanitary thumb guard.

tion of the many measures that may be used in the prevention of malocclusion would make a good-sized book; therefore, this paper will deal with but one phase of the subject, that phase pertaining to what I choose to call "interception"—the placing of a check on tendencies toward abnormality; the diverting of eruption of permanent teeth, and arch form, into lines of more normal growth and development which shall minimize their malocclusion, and thus avoid severe complications at a later period when active orthodontic treatment may be necessary.

In a conscientious endeavor to fulfill our responsibilities, we have eagerly read the many helpful articles published, and have listened to the many brilliant lectures delivered on the subject of the prevention of malocclusion, and as our experiences have increased with our increasing practice, we have become more conscious that the things written and talked about as preventable were usually well on their way as deformative factors before the orthodontist was given the opportunity to apply the remedy. Prevention had become impossible; interception, imperative.

Because of the biologic fact that the hardihood and perfection of a race can be maintained only through the elimination of the weak and of those who are physically unfit for reproduction, and because environments of ease tend to protect such weaklings, it follows that, within such environments, race deterioration will progress much more rapidly than under hard conditions of existence that automatically weed out defective individuals.

The next deduction is that with man's ever-increasing inclination to seek a life of ease, with its afforded protection of defectives, physical imperfection will occur more and more frequently, until normality becomes the exception rather than the rule. In fact, so rapid has been the process of deterioration that, in most of the cases brought to us today, basic preventive measures do not lie within the scope of orthodontia; in the majority of them, means of interception only can be applied.

NUTRITION

The earliest means of intercepting malocclusion, particularly of the neutroclusion class, but applicable to all classified types of malocclusion, is the instituting of an adequate diet. The recent research work of Howe has con-

clusively proved this, while Howard and others have clinically demonstrated beyond all doubt the advantages gained in the eruption of teeth, and in promoted growth of the jaws, through a dietary course that favorably influences metabolic activities of the entire physical system.

The matter of diet should constantly be borne in mind during our treatment of any case, for acceleration of body growth cannot be maintained where there is a lack of nutrition due to improper or insufficient food.

In the absence of a standard of nutrition high enough to nourish the body, and to promote its growth, our efforts in orthodontic treatment become as void of results as if we were working on dry bone; hence, nutrition is the first and most important one of the many means available to us for use in the interception of malocclusion.

HABITS

When we attempt to discuss the subject of habits, we enter a field of speculation, theory and argument as to their etiology, a field which I shall not try even to review, proceeding to touch on a few practical means of intercepting malocclusion resulting from the very common habits that interfere with normal growth. Thumb and finger sucking may be classed as the most common of the many pernicious habits

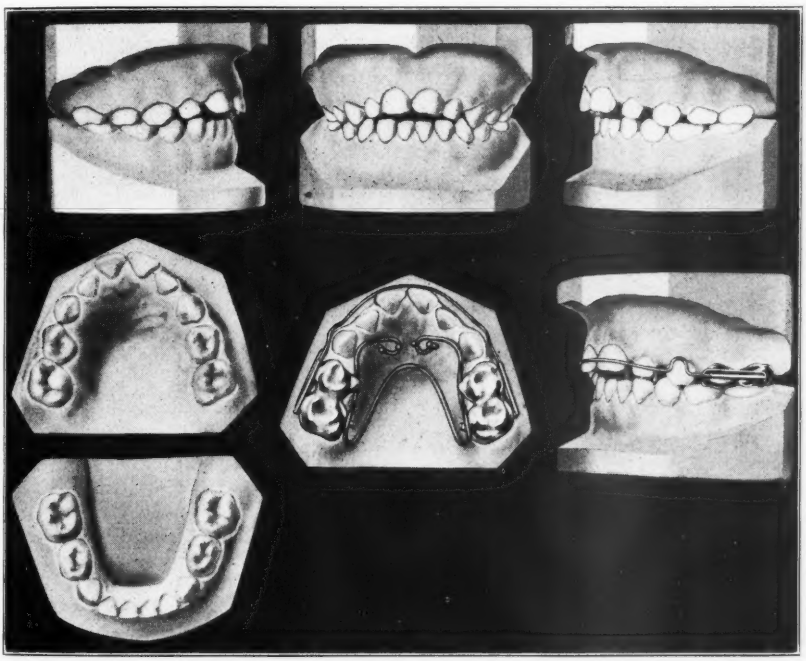

Fig. 2.—Appliance for the interception of the tongue and thumb sucking habits.

affecting arch formation and occlusion of the teeth.

It has been suggested by Hugo Franz that every mother should be warned against permitting the child to go to sleep at the breast or while nursing from a bottle, as from such practice the child readily acquires the habit of sucking the thumb or finger. Many means of intercepting this habit have been suggested and put into use, but, in my experience, the corrective device that has proved to be of greatest value is the one known as "Jackson's sanitary thumb guard," which can be procured from the Child Welfare Guild, a civic organization of New Haven, Conn. (Fig. 1.)

Another form of appliance (Fig. 2) was designed for a patient, 3½ years old, in whom the habit of intermittent thumb sucking and of forcing the tongue between the teeth had produced an open bite and protrusion of the maxillary incisors. In this particular case, the appliance was but partially efficient in checking the tongue and thumb sucking habits; still, it proved of sufficient value to warrant its recording for future reference in the treatment of similar cases. The thumb guard was used in conjunction with this appliance.

The appliance consisted of cast hard gold overlays for the maxillary first and second deciduous molars. The lingual wire was 0.036 inch and was anchored to the deciduous molar overlays with round pin and tube. The stabilizing hold-down lugs on the first deciduous molar overlays aided in maintaining the lingual wire in position. Vertical ball-headed pins were soldered to the free ends of the wire, their purpose to intercept the tongue habit as well as that of the thumb.

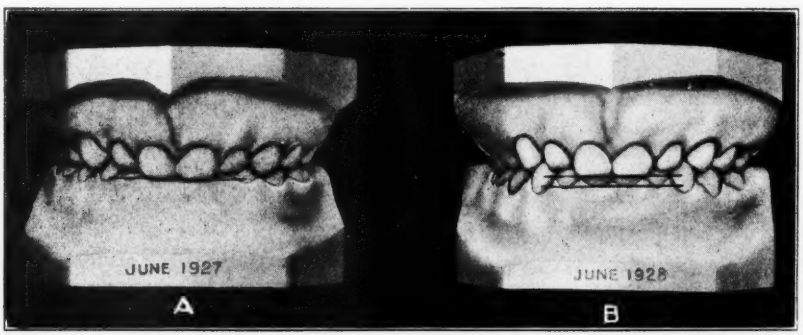

Fig. 3.—Simple infraclusion. *A*, occlusion before treatment; *B*, occlusion after one year's treatment.

On the buccal surface of the overlays, 0.023 inch bore closed distal end tubings were soldered. The alinement wire was formed with 0.023 inch spring metal wire, looped in the region of the cuspids, and was held in place by finger spring wires soldered 2 mm. anteriorly from the mesial end of the buccal tubing when in place. The free end of the finger spring wires passed over the distal ends of the buccal tubing at the soldered junction with the overlays, thus locking the alinement wire in

place. The protrusion of the incisors was reduced by closing the loops in the alinement wire.

A complete description of the cast overlay technic applicable to the anchorage of such appliances will be found in an article titled, "Cast Overlay Technic and Its Application in Practice," read before the American Society of Orthodontists at Buffalo in May, 1928.

INTERCEPTION OF INFRACLUSION AND DISTOCLUSION

Predisposing influences of a pathologic nature having been disposed of or brought under control, a progressive infraclusion, and its frequent combination with distoclusion of the deciduous arch, can be effectively intercepted in many cases, and growth diverted into normal channels. The means of making

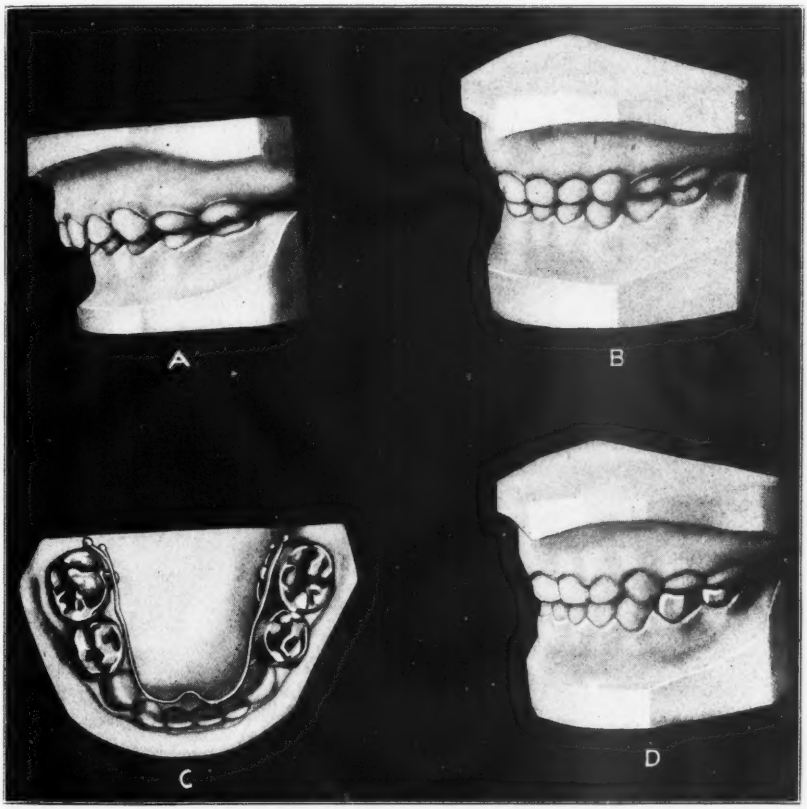

Fig. 4.—Infraclusion complicated by distoclusion. *A*, occlusion before placement of the appliance; *B*, casts mounted on an articulator, in normal arch relation; *C*, appliance as placed on lower deciduous molars; *D*, arch relation as maintained through change in occlusion.

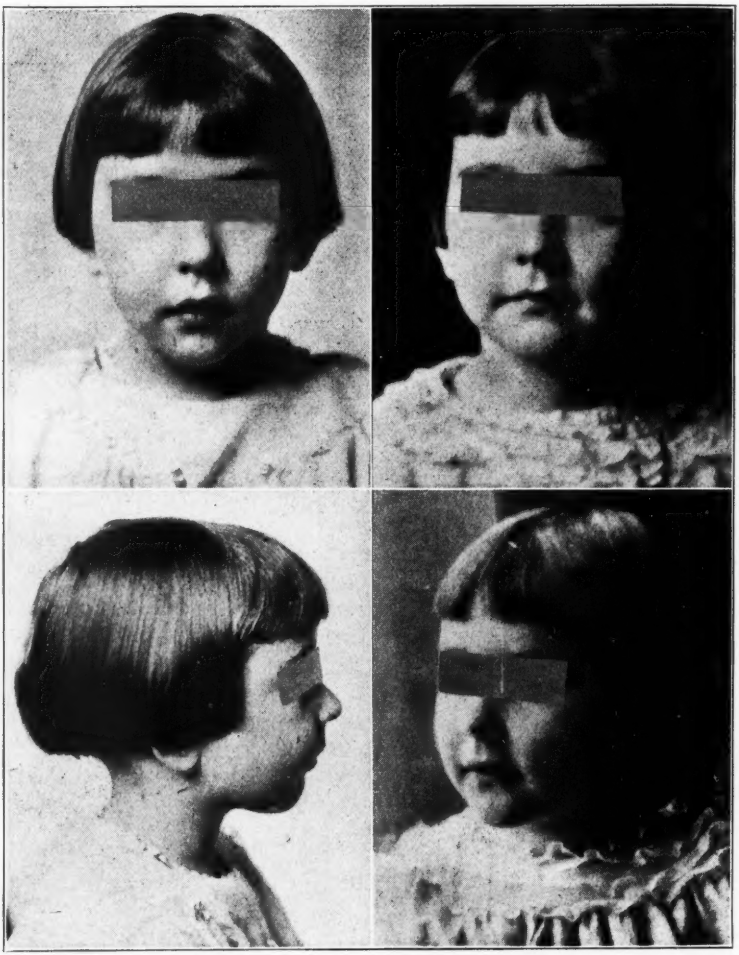

Fig. 5.—Physical change in features following the placement of appliance as shown in Figure 4 *C* and *D*.

such corrections are very simple, and the frequency of good results from interceptive procedure warrants its more frequent practice, even though the results will vary in the cases encountered, and further corrective treatment may be necessary at a later time.

TREATMENT

In cases in which the arch relation is normal, treatment of simple infraclusion may be accomplished in the following manner: Prior to the eruption of the first permanent molars, raise the bite by placing on the deciduous molars of

one side of the mandibular arch an overlay of sufficient thickness to open the bite about 0.5 mm. As soon as the teeth on the opposite side come into occlusion, place an overlay on that side and remove the first one placed. The changing of the overlay from side to side will be necessary every four to six weeks.

Figure 3 shows the result of one year's treatment of simple infraclusion of the deciduous teeth, prior to the eruption of the first permanent molar. The treatment followed the method just described, and measurement in the incisor area shows that vertical development has taken place to the extent of 2 mm.

Figure 4*A* shows a typical case of infraclusion complicated by arch mal-

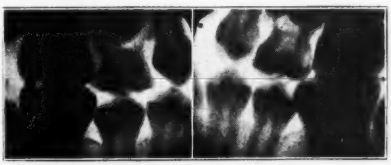

Fig. 6.—Example of prolonged retention of the maxillary second deciduous molars, resulting in malocclusion of the bicuspids.

relation, the mandibular teeth being in distoclusion. The treatment of this case varied from that of simple infraclusion in that single overlays were made for the lower right and left first and second deciduous molars. These single overlays were placed upon a model mounted on an articulator and adjusted to normal mesiodistal relation with the teeth of the maxillary arch. The jaws of the articulator were closed upon soft wax, which was then trimmed, removed, cast in hard gold and soldered to the overlays. When finished, they appeared as shown in Figure 4*C*, and maintained occlusal relation as shown in Figure 4*D*. Immediate change in the features occurred as recorded in Figure 5.

While the wearing of such an attachment to the lower deciduous molars may annoy the patient at first, compensation will occur through the advantage gained in the functioning of the teeth, owing to their changed relation of occlusion.

The overlays were worn until the first permanent molars were beginning to erupt. They were then removed from the first deciduous molars. Later, as the first permanent molars were erupting into occlusion, the overlays on the second deciduous molars were removed.

While orthodontic treatment for arch expansion was applied in this particular case, the principal desideratum was the correction of arch relation and infraclusion, a correction which was followed by pronounced vertical development with the eruption of the first permanent molars.

The plan of interceptive treatment in the cases of infraclusion shown is not original with me. Credit is due to Delabarre for the most outstanding clinical reports of such treatment.

JUDICIOUS EXTRACTION OF DECIDUOUS TEETH

While it is generally recognized that the prolonged retention of deciduous teeth is frequently a causative factor of malocclusion and resultant abnormal development, an observation of usual practice reveals the fact that the general practitioner seldom extracts a deciduous tooth except for the following reasons:

1. It is loose and causing irritation of soft tissues.
2. The succeeding permanent tooth is erupting.
3. It is abscessed.
4. It is carious and he does not care to fulfil his obligation as a dentist by

proper operations which may be of a difficult nature.

Nature's plan seems to be that the resorption of the roots of deciduous teeth occurs as the permanent teeth develop, that the deciduous teeth are shed a short time before the eruption of their permanent successors and that the loss of a lower deciduous tooth usually occurs slightly in advance of that of the corresponding upper tooth. When Nature's plan works harmoniously, it is favorable to normal occlusion, but variations that are the onset of malocclusion frequently occur.

We are indebted to Charles R. Baker for much original research and theory relating to supervision of the removal of the deciduous teeth in the interception of malocclusion. I indorse the soundness of theory and practice of Baker by more than twelve years of its application in practice.

The importance of supervising the normal shedding of deciduous molars and the eruption of the bicuspids cannot be overestimated, for unless changes occur in that area in a normal manner, malocclusion of the bicuspids and molars is certain to occur.

Quoting from Baker:

> This is true for two reasons—first, the bicuspids erupt in a location between two areas occupied by permanent teeth and well developed alveolar process, and, second, they are smaller in mesiodistal width than the deciduous molars. The corresponding upper and lower deciduous molars on the same side of the arch should be lost at approximately the same time, if the jaws are to develop harmoniously. In my own practice, when a bicuspid has fully erupted, I remove the corresponding deciduous molar in the opposite jaw. If malocclusion is present, it may not always be advisable to follow this rule, but it usually applies if the mesiodistal relationship of the arches is normal.

Fig. 7.—Cases in which judicious extraction of deciduous cuspids and molars resulted in a more normal eruption of the permanent teeth.

More exhaustive information in Baker's own writings on the subject will be found in *The Dental Review*, 1916; *The International Journal of Orthodontia*, 1917; and THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION, 1920.

The necessity of supervising the extraction of deciduous teeth is clearly shown in Figure 6. The prolonged retention of the maxillary second deciduous molars has produced a malocclusion of the first bicuspids which could have been intercepted if the deciduous molars

had been removed at the right time. Figures 7 and 8 show the result of judicious extraction of the first deciduous molars and deciduous cuspids, which has brought about a more normal progression in the eruption of the cuspids and biscuspids.

PREMATURE LOSS OF DECIDUOUS MOLARS

During recent years, many articles have appeared in general and special dental literature dealing with the subject of the premature loss of the deciduous teeth and the prevention of malocclusion incident thereto. In the many references available, but little thought appears to have been directed to the maintenance of function. The one apparent objective has been the maintenance of space in the affected area, which falls far short of being a complete interception of malocclusion.

Fig. 8.—Cases in which judicious extraction of deciduous cuspids and molars resulted in a more normal eruption of the permanent teeth.

The anchorage for apparatus designed for such purpose, described and illustrated in these many articles, has been the commonly used anchor band for orthodontic appliances. Now for several reasons, this band does not fulfill the basic requirements for the construction of a space maintainer.

1. Owing to the fact that patients for whom space maintainers have been made are not always under the continuous care of the dentist or orthodontist, the opportunity for the repairing of a broken band, or cement attachment to the tooth, is not afforded until actual injury has occurred to tooth structure or gingival tissues.

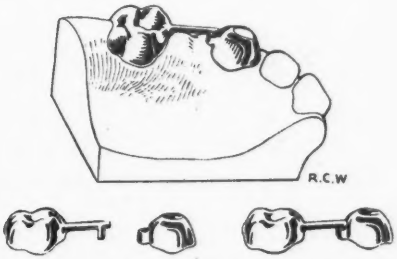

Fig. 9.—Cast overlay anchorage space maintainer.

2. Because the stress brought upon such appliances is in direct line with the forces of occlusion in mastication, the secure attachment of all parts of the design is necessary.

3. In the maintenance of a normal progression in growth and development of the dental arches, the restoration of function is an important factor, demanding of an appliance greater strength and more security of anchorage than anchor bands can afford.

Four years ago, with these three basic facts in mind, I made a space maintainer and it has been applied in a sufficient

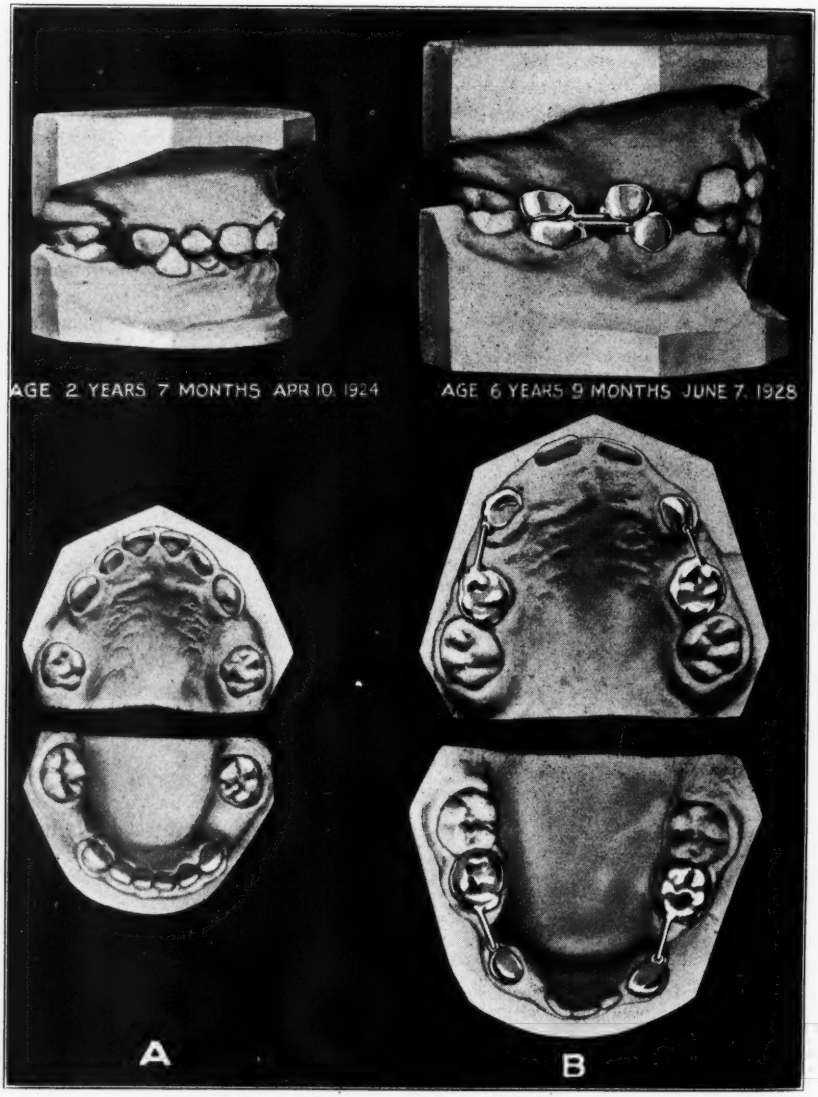

Fig. 10.—Practical application of space maintainer in practice, showing the general arch development that occurred in the course of four years.

number of cases to prove its value through the actual results obtained through its use.

Probably the most frequent premature loss due to caries of deciduous teeth is that of the first deciduous molar. Figure 9 shows a type of space maintainer that can be easily constructed for such a condition. It consists of cast overlays for the second deciduous molar and cuspid, connected by a rigid semi-fixed bar, with a soldered connection to the molar overlay, and the mesial end of the bar supplied with a vertical pin that rests in a short vertical tubing soldered to the distoproximal surface of the cuspid overlay. Such appliances not only maintain space, but also restore function in the affected area.

Fig. 11.—Practical application of the type of appliance illustrated in Figure 10.

Figure 10*A* shows models of a case in which four such space maintainers were placed on the teeth of a delicate child, 2 years and 7 months old, for whom it had been necessary to extract four first deciduous molars. Figure 10*B* shows how a fairly normal growth of the dental arches was maintained throughout a period of four years, until the time of the eruption of the first permanent molars.

Figure 11 shows another of the same type of space maintainer that was placed in the lower left deciduous molar area. The anchorage consisted of cast hard gold overlays on the first deciduous molar and the first permanent molar, connected by a semi-fixed bar. This appliance has, for more than a year, maintained space for the bicuspid, at the same time maintaining function and preventing the deciduous molar of the upper arch from dropping out of occlusal alinement.

An even simpler maintenance of space was effected in the case of a child, aged 6 years and 7 months, in which an early loss of the lower second deciduous molars had occurred. (Fig. 12.) Cast overlays were made for the upper second deciduous molars, the overlays having a heavy cast spur on the occlusal surface that occluded with the mesioproximal surface of the lower first permanent molars. This case has been under observation for two years, and the pictures shown are of recent date, furnishing evidence not only that malocclusion has been intercepted, but also that a general improvement has taken place in the dental arches. The tendency of malocclusion was mesially to normal.

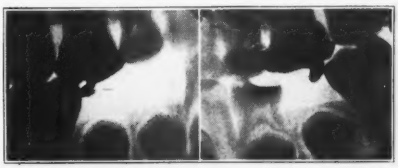

Fig. 12.—Single overlays with occlusal spur which intercepts mesial migration of the lower first permanent molars.

The premature loss of the second deciduous molars prior to the eruption of the first permanent molars has been looked on by many practitioners as the beginning of complications beyond our power to intercept. The remedy consists of a simple fixture which has proved its efficiency in many cases; in fact, from

its application, I have come nearer to 100 per cent of desired results than from any other that I have to offer at the present time. This appliance is shown in Figure 13.

The fixture to be used in such cases is comprised of a combined cast overlay anchorage which covers the first deciduous molar and cuspid, with a distal extension that engages the mesioproximal surface of the unerupted first permanent molar. Access is gained to the first permanent molar by a slight operation which removes just a sufficient amount of tissue to expose that area of the first permanent molar against which the distal extension of the overlay anchorage is placed. The distal extension also serves as an occlusal rest for the second deciduous molar of the opposing arch, thereby restoring function; which is fully as important as intercepting a migration of the teeth that would disturb normal occlusion.

Figure 14 shows roentgenograms taken in such a case, illustrating how the first permanent molar was guided into normal position and occlusion, and how the upper second deciduous molar was maintained in occlusal alinement.

The models shown in Figure 15 plainly reveal what occurred in occlusal malalinement of the upper second deciduous molars where no protection against this displacement was installed. The upper second deciduous molar has dropped down until it is in contact with the soft tissues of the lower arch when the jaws are closed.

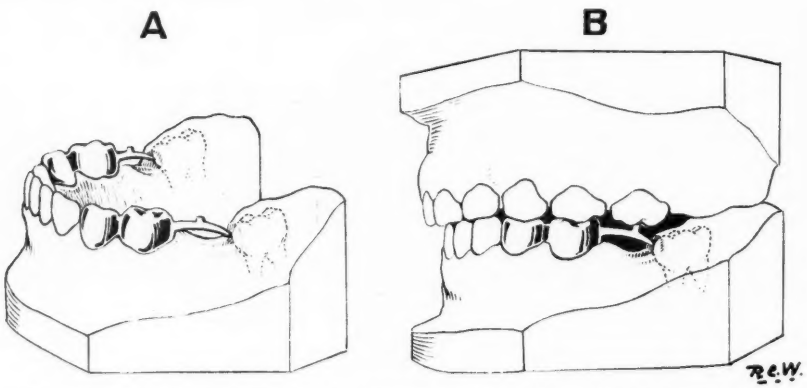

Fig. 13.—All cast one piece space maintainer serving three distinct purposes: (1) preserving space for the second bicuspid; (2) restoring limited function in the affected area and maintaining the position of the upper second deciduous molar; (3) guiding the lower first permanent molar into position.

MULTIPLE LOSS OF DECIDUOUS TEETH

Though they are rare, cases do occur in which there is a multiple loss of deciduous teeth at 3 years of age or near it. In such cases, fixed appliances cannot be used as a means of intercepting malocclusion and arch deformity, but removable partial dentures can be made that have proved efficient in a number of cases, to the extent of maintaining arch form and restoring function. In

the case of a little girl, 3 years and 6 months old, it became necessary because of infection, due to caries and systemic involvement, to remove from the upper arch the first molars and the four incisors, and from the lower arch, the four molars; ten teeth in all being involved. Probably owing to impaired function, a cross-bite had developed, and the force of occlusion, bearing upon the upper left cuspid, deflected that tooth lingually.

With the correction of the malposed cuspid as shown in Figure 16*A* and *B*, partial dentures were made, as shown in *C*. These dentures have been giving the little patient service for almost two years, and the first permanent molars

Fig. 14.—Left: Guiding influence of the cast extension. Right: Maintenance of occlusal alinement of the upper second deciduous molar until the first permanent molars are in full normal occlusion.

are now erupting. One of them is in evidence in Figure 16*C*. Owing to changes that are taking place in the angle of the mandible, it is evident that there will be no lack of vertical development.

DISCUSSION

A. C. Rohde, Milwaukee, Wis.: The subject of prevention or of interception, as Dr. Willett prefers to call it, is a timely one. We are living in an age of prevention. At present, we have a number of weeks set aside by the Government for the prevention of certain things, such as fire-prevention week, when a concentrated effort is made to impress on our minds what we can do to prevent fires. We need more than a week to preach the gospel of prevention of malocclusion. It will take a long time before this sort of education takes root, but we are progressing. The general practitioner of dentistry is the greatest asset that we have in disseminating the truth regarding interception of malocclusion, and yet it is surprising how many patients come to the orthodontist with the statement that their dentist said "Wait until all permanent teeth are erupted" or "Nature will take care of that." I was glad to hear Dr. Willett stress the importance of diet. Not only should the orthodontist bear this in mind during treatment, but the obstetrician also should instruct expectant mothers as to its extreme importance. The subject of habits was well covered, especially as regards thumb and tongue sucking. It seems that, in some of these persistent cases, everything that the operator can do fails to check this habit, and, oftentimes, success is not forthcoming up to the age when the child can be reasoned with, and then the damage is done. In these cases, I have met some success by showing the photograph, together with models of an extreme case, to the little patient and explaining that if he persists in sucking his thumb, he will be disfigured to the same degree as the patient in the picture. This seems to have the desired psychologic effect, and in most cases this pernicious practice is arrested. Of late years, Dr. Stallard of San Diego has stressed the pronounced prevalence of incorrect sleeping habits of children. These habits not only affect the

jaws, but other parts of the skeletal system as well. The early extraction of deciduous teeth, to my mind, is one of the important causes of malocclusion, and the one most easily intercepted. From my observation, I could count the number of retainers inserted to maintain space by the general practitioner on the fingers of one hand. I believe that Dr. Willett's method of retaining the first molar before its eruption, after the second deciduous molar is lost, is unique. The only criticism I could offer to his method would be as to the discomfort caused by the overcaps being on one side only, thus causing a slight open bite. There are a number of other causes of malocclusion which could be intercepted but which Dr. Willett probably did not mention for want of the time, such as the presence of supernumerary teeth, mouth breathing, carious teeth and an abnormal frenum, and the early loss of permanent teeth. It is a fact that most cases of malocclusion can be prevented if the causes are recognized at their inception and treated, but unfortunately this is not often the case. I would advise everyone who has not done so to read the editorial on prevention in the August JOURNAL, from which I quote the last paragraph: "And thus prevention's precious reign is ushered in, and hope is high, and cheer and joy abound; and in that day when this rare Prince shall reign throughout the earth, the sons of men may tune their hearts to happiness and mirth."

F. A. Delabarre, Boston, Mass.: Dr. Willett's use of the word interception instead of prevention is very apt. No matter how early in life we undertake the management of these cases it is too late to prevent; but we intercept malformation and prevent it from becoming much more complicated. If we as orthodontists could only impress on the dental profession as a whole the importance of space maintainers in all cases of premature loss of temporary teeth, it would not only be a tremendous gain for the patient, but also if that patient later, having worn the space maintainers, came into our hands for further work, the malocclusion would be much less complicated and the difficulties confronting us at that time would be much simpler. I was glad to hear Dr. Willett speak of the vertical relationships of the teeth, because our profession has more or less neglected that phase of our work. There is almost nothing in the literature in regard to it, and I am glad to have Dr. Willet's corroboration regarding the treatment, particularly in these young patients.

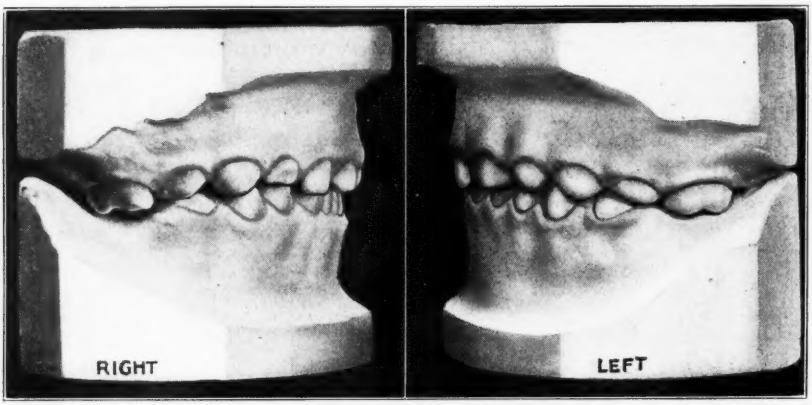

Fig. 15.—Occlusal malalinement of the upper second deciduous molars due to premature loss of the lower second deciduous molars.

Charles R. Baker, Evanston, Ill.: The experience of orthodontists in general agrees with the statement made by Frederick B. Noyes several years ago that 75 per cent

of the cases of malocclusion that he had under treatment could have been prevented by the general practitioner. Probably, every dentist knows that two of the important causes of malocclusion are the too early loss and the too long retention of the deciduous teeth. It is indeed unfortunate that, in the majority of children's mouths, the deciduous teeth are not properly cared for and that they are not lost at the correct time in the development of the individual. Probably, the parents are usually to blame, in that they do not take the children to the dentist at frequent, regular intervals, and, in other cases, the dentist fails to fulfill his obligation. Many deciduous teeth are prematurely lost, and in but few of these cases are space-maintaining appliances used. Many deciduous teeth are retained too long in the dental arches. Many cavities in deciduous teeth are filled in such a manner that the proper size and contour of the tooth is not restored. Sometimes, we find that a dentist has placed a filling which occupies cavities in two adjoining deciduous molars, connecting these teeth, when he should know that one of these teeth is normally lost a year in advance of the other. The orthodontist would like to urge the man in general practice to consider the occlusion particularly, as well as the physical condition of the individual teeth. It is far more important to prevent than to treat malocclusion, and prevention of malocclusion necessitates an early recognition of abnormal development. Dr. Willett was kind enough to mention the plan that I use in studying the correct time for the loss of deciduous molars. If we are to have harmony in the development of the upper and lower arches, we must have a deciduous molar in one arch opposite the corresponding deciduous molar in the opposing arch. If a deciduous molar has been lost prematurely, the width of the lost molar should be maintained by an appliance. As soon as a first bicuspid erupts, I believe in the removal of the corresponding deciduous molar in the opposite arch. The same practice is followed in regard to the second bicuspid region. If we have a bicuspid in one arch occluding against a corresponding deciduous molar in the other arch, there cannot be a harmonious development of both arches on that side of the mouth. Of course, it is not always advisable to follow out this plan if there are other conditions of malocclusion involved which might require treatment in some other way; but if the permanent first molars are in normal mesiodistal relation, this treatment is invariably successful.

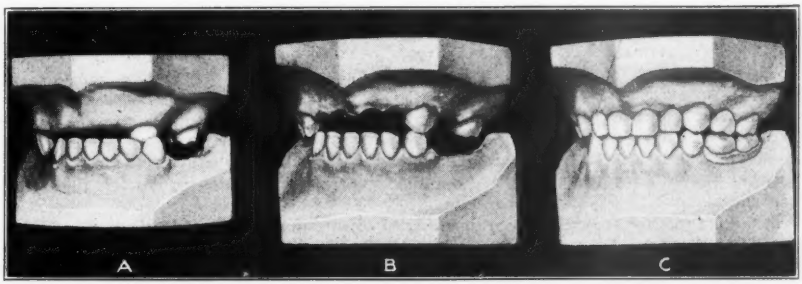

Fig. 16.—Multiple loss of deciduous teeth. *A*, malocclusion resulting; *B*, occlusion corrected; *C*, corrected occlusion maintained with partial dentures.

F. L. Stanton, New York City: I bring to your attention certain facts that have been found by studying three dimensional graphs of normal and abnormal dentures. Dr. Denzer, a pediatrician, made models of thirty-nine infants under 6 months of age and plotted, with my surveying instruments, three dimensional maps of these palates. The outline of the dental arch was as large (as far back as the second deciduous molars) as the surveys of children's dental arches are at the sixth year in those cases in which there is little or no spacing of the deciduous incisors. If a series of cases be studied, by means of maps, it will be found that, where

there is insufficient space developed for the normal eruption of the permanent incisors, the addition to the palate to accommodate the first permanent molar has succeeded in growing in length to accommodate the first molar and in width is nearer the norm than the section of palate accommodating the deciduous molars. Consequently, the first permanent molar tends to erupt in a more nearly normal position than the deciduous molars, but, as it must assume a contact with the distal end of the deciduous denture, a rotation of the mesial contact takes place, and we have established the characteristic rotation of the first permanent molar as seen later in many of our cases of malocclusion. This seems to indicate that we must focus our attention in finding the cause of this early failure of the palate to grow in width in the deciduous molar region. This arrest becomes more significant when we realize that, in growth, the palate becomes more normal in width as it lengthens for the first permanent molar, and by the twelfth year it has lengthened and widened normally to accommodate the second molar, no matter how great the arrest of development may be in the deciduous molar area, even in the extreme "saddle arch" type. It has been common practice to apply force to the deciduous molars to create space for the normal eruption of the permanent incisors. Bogue suggested his diagnostic measurement to determine the necessity of widening the deciduous arch. He suggested that any deciduous arch that measured less than 28 mm. between the second molars required expansion. My criticism of this plan is that it fails to tell the operator how much expansion is required. The following measurement is suggested to supersede the Bogue plan: The combined widths of the lower (this measurement holds good on the lower only) deciduous molars and cuspid about equal the space required for the four permanent incisors. The error will not exceed 1.3 mm. The temporary side unit will vary from 18 to 26 mm. The technic of this measurement is as follows: 1. With a pair of dividers, measure the combined widths of the lower deciduous molars and cuspid and transfer the measurements to a card. If there is a space between the cuspid and first deciduous molar, deduct the width of the space from the measurement. 2. Measure the distance between the mesial contacts of the deciduous cuspids. 3. Compare the first measurement with the second. The difference will be the required expansion needed to provide sufficient space for the eruption of the permanent incisors. If the deciduous arches are buccolingually and mesiodistally correct, the same expansion should be made on the upper arch. For example, if the lower side unit measures 23 mm. and the front unit 16 mm., the required expansion will be 7 mm.

Dr. Willett (closing): Dr. Rhode mentioned the possibility of the occlusal thickness of the overlay anchorage interfering with occlusion. When the overlay is made as described in a paper that I read before the 1928 meeting of the American Society of Orthodontists in Buffalo, it will be found that the thickness of the overlay does not interfere with occlusion to the degree of being the annoyance that some might suppose it would. Briefly stated, an accurate impression is taken in modeling compound (Baker Method) of the tooth or teeth selected as a base of anchorage for the space maintainer. The impression is run up in investment compound. Over the model thus secured, 30-gage sheet casting wax is adapted to form the pattern for the overlay. The pattern is rubbed down on the model with cotton moistened in 48 per cent grain alcohol. The rubbing and smoothing with cotton and alcohol reduces the thickness of the wax pattern, which is further reduced in the process of final finishing after casting in alloy. The alloy that I have found most suitable for the casting of overlays is one of 8 per cent platinum content. All attachments to teeth have their disadvantages, but when we consider the fact that the overlay cannot be jammed over the crown and into the investing tissues, if it becomes free of cement attachment, as frequently happens when anchor bands are used, at least one important point in favor of the overlay should be conceded. There is an opportunity to help the general practitioner of dentistry through the orthodontists' attending dental meetings and discussing with them problems of mutual interest, matters that are essentially the work of both, such as I tried to bring before you in my paper. In working together on these problems, we will both do a greater service for humanity.

A CONTRIBUTION TO THE KNOWLEDGE OF THE PHYSIOLOGIC CHANGES IN THE PERIODONTAL MEMBRANE*

By BALINT ORBAN, M. D., Chicago, Ill.

IT is, of course, an axiom that a proper knowledge of normal physiologic processes must precede a discussion of pathologic ones. This has been stressed so frequently that further mention of this point seems superfluous. Yet descriptions in the literature of reactions, termed pathologic, but which in reality are merely normal physiologic conditions appear so often that it seems worth while to reaffirm this point. Furthermore, a morphologic description of a structure that is not correlated with its biologic relationships is without great value. These words are not in criticism of any investigator, for no one is free from the danger of making mistakes in his interpretations. It is only by the constant accumulation and evaluation of new material and new findings that knowledge progresses. Frequently, it has happened that mistakes in research have done more to develop knowledge than positive findings, because of the stimulus that they have given to further investigation.

The following discussion of findings brings us somewhat nearer, it seems to me, to an understanding of the physiologic processes which take place in the periodontal membrane. The structures of importance in the study of pathologic processes which for many years have been called pyorrhea are the periodontal membrane and its limiting walls, the cementum and the alveolar bone. I shall not discuss the disease-complex pyorrhea, but shall confine myself in this paper to a consideration of some physiologic conditions of the periodontal membrane.

In 1924, H. K. Box[1] published a paper on "Studies in Periodontal Pathology." In this paper, Box described the formation in the periodontal membrane of a "new tissue," which was held responsible for the resorption of the alveolar process and the destruction of the periodontal membrane. Box termed this disease "rarefying pericementitis fibrosa." He writes (p. 33): "The process consists of the formation, in the pericementum, of a new tissue which, on the one hand, changes the normal arrangement of the pericemental structures, and, on the other, replaces the bone substance of the alveolar process." This "new tissue" is shown in many illustrations. In 1926, B. Gottlieb[2] investigated this subject and came to the conclusion that this tissue is found in every

*Read before the Chicago Dental Society, May 22, 1928.

*From the Research Department of the Chicago College of Dental Surgery, Dental Department of Loyola University.

1. Box, H. K.: Studies in Periodontal Pathology, Canadian Dental Research Foundation, Bull. 7, May, 1924.

2. Gottlieb, Bernhard: Paradental Pyorrhea and Alveolar Atrophy, Fortschr. d. Zahnheilk., 1926, No. 5, p. 363.

Fig. 1.—Distal side of alveolus, human tooth; horizontal section. *a*, embedded Sharpey fibers in the so-called bundle bone. *b*, lamellated bone. *c*, resorption of bundle bone from the marrow space *(d)*. *e*, dentin. *f*, cementum. *g*, "space" in the periodontal membrane containing blood-lymph vessels and nerve fibers.

specimen, and that it is not pathologic, but is the normal content of the periodontal membrane. J. A. Marshall[3] also recognized the normality of this tissue. It is a soft connective tissue in which the normal blood and lymph vessels and nerve fibers are embedded. Gottlieb has shown that the shape of the spaces in the periodontal membrane depends on the movement of the teeth, which are in constant physiologic movement proceeding mesially.

Owing to this wandering of the teeth, the fibers of the periodontal membrane on the distal side of the teeth are stretched, while those on the mesial side are relaxed. For the same reason, the spaces on the distal side containing the vessels and nerves are a long elliptic shape, and more nearly round on the mesial side.

A few years ago, Stein and Weinmann[4] described the microscopic findings which occur during the physiologic wandering of the teeth. They have shown that alveolar bone on the side from which the teeth are moving is rich in Sharpey fibers. Many fibers of the periodontal membrane are embedded on this side, and they called this bone "bundle bone." On the side of the alveolar bone toward which the teeth are wandering, there are normally no similar embedded fibers and the bone is of the common lamellated type. This bone shows resorption toward the periodontal membrane. The resorption, therefore, is mostly on the mesial side and the bundle bone on the distal side. They have shown that the teeth are moving from the distal alveolar process toward the mesial, and during this movement, new bone is deposited on the surface of the distal alveolar bone toward the periodontal membrane. The newly built bone thereby embeds the fibers of the periodontal membrane, and thus bundle bone originates.

Figure 1 shows the bundle bone on the distal side of a human incisor. At *a*, we can trace the principal fibers of the periodontal membrane into the bone. Stein and Weinmann stated that this bone does not remain intact throughout life, but is resorbed from the marrow spaces behind the alveolar bone. It remains only on the surface of the alveolus to keep the fibers embedded. Figure 1 shows also the resorption of bundle bone from the marrow space (*c-d*). After resorption ceases, new bone is deposited from the lamellated type (*b*). The resorption of bundle bone from the sides of the marrow spaces causes the resorption lacunae to open toward the lamellated bone. In the same picture, blood vessels, lymphatics and nerves may be seen in many places embedded in the periodontal membrane (*g*).

On the mesial side of the same tooth, Figure 2, the alveolar bone is without the Sharpey fibers and is of the lamellated type. There are resorption lacunae on the surface of the bone toward the periodontal membrane (*d*). The resorption osteoclasts in this case are not large polynuclear cells, but are mononuclear. Spaces containing blood vessels and nerves are numerous (*c*).

At *f*, there is a marrow space in which there is no sign of active resorption. The marrow is not fatty but fibrous in type. Some investigators consider this type of marrow the result of inflammatory reaction. The section from which this photograph was made is about at the middle of the root, far

3. Marshall, J. A.: Diseases of the Teeth, 1926, p. 256.

4. Stein, G., and Weinmann, I.: The Physiologic Wandering of the Teeth, Zeitschr. f. Stomatol., 1925, No. 8, p. 733.

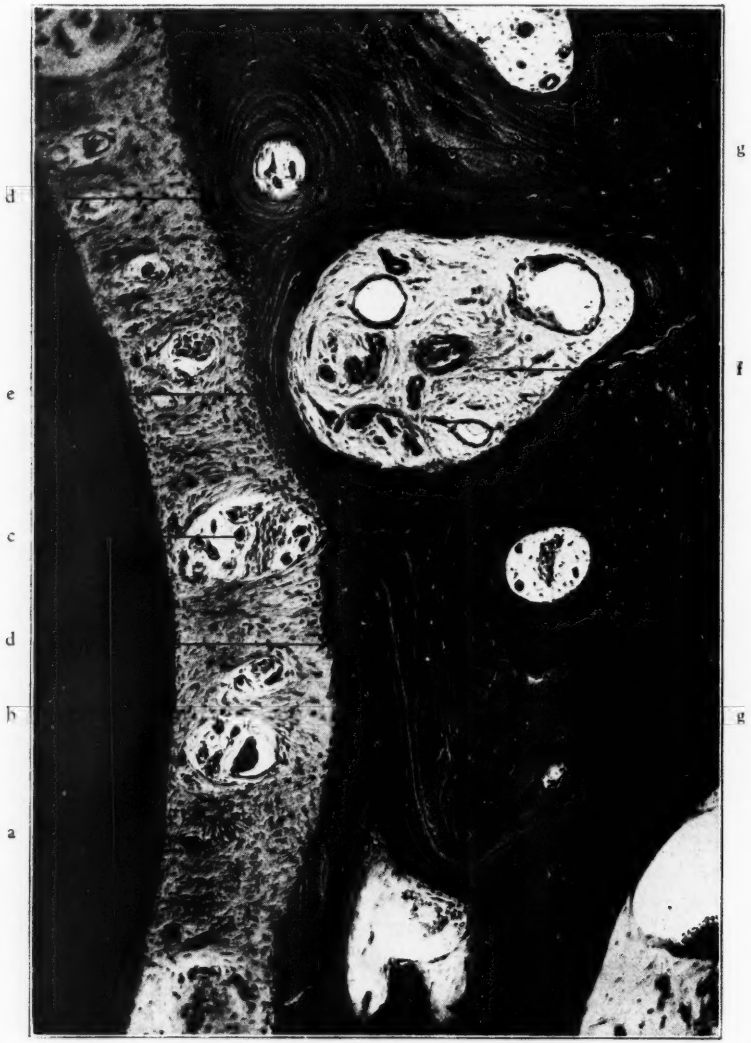

Fig. 2.—Mesial side of alveolus, human tooth; horizontal section. *a*, dentin. *b*, cementum. *c*, "space" in periodontal membrane. *d*, resorption lacunae on the wall of the alveolus. *e*, narrow bone trabecula separating a marrow space *(f)* from the periodontal membrane. *g*, lamellated bone. (There is no bundle bone on this side of the alveolus.)

Fig. 3.—A section somewhat nearer the apex than that shown in Figure 2. The marrow space *(f)* is in communication with the periodontal membrane *(d)*. *a*, dentin. *b*, cementum. *c*, "spaces" in the periodontal membrane containing blood vessels, lymphatics and nerve fibers. *e*, resorption on the wall of the alveolus. *g*, lamellated bone.

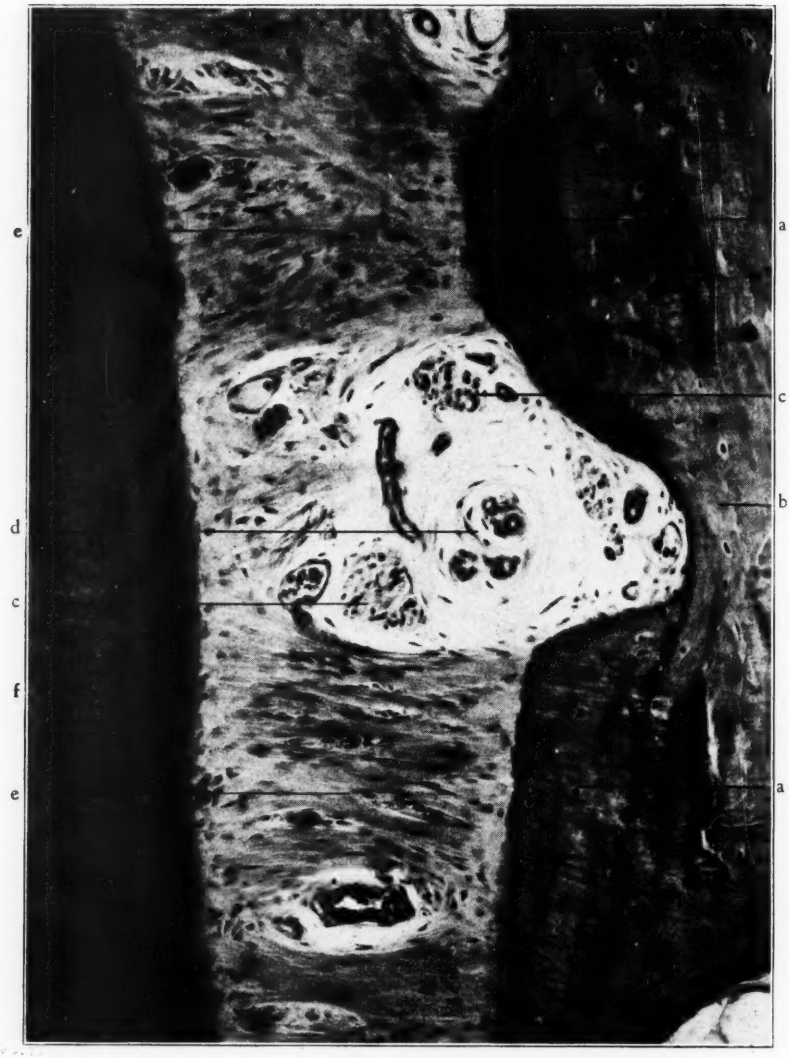

Fig. 4.—Horizontal section, human tooth; distal side. *a,* bundle bone, on both sides of a "space" in the periodontal membrane containing blood vessels *(d)* and bundles of nerve fibers *(c).* Behind these structures, the bone is of the lamellated type *(b). e,* principal fibers. *f,* cementum.

Fig. 5.—Human tooth, horizontal section; distal side. *a*, processes of bundle bone. *b*, "spaces" in the periodontal membrane lying in baylike depression of the bone. *c*, lamellated bone behind the periodontal membrane spaces. *d*, cementum. *e*, dentin. *f*, lamellated bone. *g*, marrow space.

Fig. 6.—At *A-A*, bundle bone encloses a former space *(B)* of the periodontal membrane. *a*, bundle bone. *b*, lamellated bone behind the periodontal membrane spaces. *c*, cementum. *d*, dentin. *e*, lamellated bone around a marrow space replacing the former bundle bone. *f*, lamellated bone.

from the gingival crevice. No direct connection between this marrow space and the outer surface could be found. This marrow formation may have been the result of the reaction caused by the resorption of bone from the periodontal membrane. In a few sections nearer the apex in this series (Fig. 3), this marrow space is open toward the periodontal membrane, and the soft connective tissue of this space, which is a normal soft connective tissue, is still separated from the fibrous connective tissue of the periodontal membrane. It shows no inflammatory change such as is indicated by the presence of leukocytes, lymphocytes or plasma cells. At *c* in this specimen are groups of blood and lymph vessels and nerve fibers. We assume that, if the wandering of this tooth had gone farther in the same direction, the tissue of the former marrow space could no longer be differentiated from the spaces of the periodontal membrane, as Gottlieb has already demonstrated.[2]

Figure 4[5] shows a space in the periodontal membrane of the distal side of an upper bicuspid, containing vessels and nerve fibers surrounded by soft connective tissue. No sign of inflammation is to be noted in this tissue, even though we construe the term "inflammation" as broadly as possible. This tissue containing the vessels and nerves lies in a little baylike depression in the alveolar bone.

H. K. Box writes (p. 44):

> Through increase in size of masses of this tissue lying in the body of the pericementum, or through proximity to the surface of the alveolar bone, of the blood vessels manifesting the reaction, these same cells encroach upon the bony surface. Accompanied by osteoblasts and osteoclasts, the absorption of bone is seen to take place, with the formation of little baylike depressions into the surface of the alveolar wall. Into these inlets, the new tissue extends in finger-like projections along the blood vessels, carrying inward reactions similar to those seen upon the surface, and producing within the bone an internal rarefaction.

An examination of Figures 2 and 3 reveals that resorption of bone on the mesial surface of the alveolus is due to the mesial wandering of the teeth as described by Stein and Weinmann. The increase in size of the spaces in the periodontal membrane ("new tissue" of Box) is due to the relaxation of the fibers of the periodontal membrane and communication of the marrow spaces with the spaces of the periodontal membrane. The resorption of bone is not the result of increase of this tissue, but the increase is the result of resorption, which in our case is due to the wandering of the teeth —a physiologic process. It is quite true that increase in size of the spaces of the periodontal membrane, by an increase of pressure, may cause resorption of the bone. This may be the case in some instances, but a consideration of these cases is beside the point of my discussion, for they lie in the field of pathology.

Figure 4 shows clearly how the baylike depression occurred. It is quite evident that, on both sides of the space containing the vessels and nerves, the fibers of the periodontal membrane may be traced into the bone (*a*). This bundle bone indicates that the tooth has moved in the direction of *a* to *e*. Behind the space where the baylike depression is to be seen, there is no bundle bone, merely lamellated bone (*b*). As the tooth wandered in the direction *a-e*, new bone was built at the alveolar wall, but only at places where fibers of the periodontal membrane previously had been embedded.

Obviously, no principal fibers cross the spaces in which lie the blood vessels

5. From Orban, Balint: Dental Histology and Embryology, Chicago: Rogers Printing Co., 1928.

and nerves; consequently, no new bone corresponding to these places is built. Thus, we see that the baylike depressions are due (1) to the physiologic wandering of the teeth; (2) to bone formation where principal fibers are embedded, and (3) to lack of bone formation where the fibers are absent.

Sometimes, the spaces in the periodontal membrane may become embedded in the bone during the physiologic wandering of the teeth. Figure 5 shows an interesting case.[6] Here, deep baylike depressions (*b*) in the bone exist along the entire wall bordering the distal side of the tooth. But between these depressions, containing vessels and nerves, bundle bone (*a*) projects toward the cementum (*d*). The bundle bone is missing behind the periodontal membrane spaces (*c*). Owing to the wandering of the teeth and the probable rapid formation of new bone, the spaces in the periodontal membrane are found lying in deep depressions in the bone. If this wandering process had continued, these spaces might have become quite embedded and surrounded by bundle bone, as may be seen in the case in Figure 6 at *A-B*. New bone lamellae have been laid down until the space is entirely surrounded.

After observing the whole series of sections (horizontal), we may also state that these structures (blood vessels and nerve fibers) are not "nodular" as H. K. Box states. By nodular, we understand something round, but this structure may be traced lengthwise from the bottom of the alveolus to the entrance. Sometimes, side branches enter from the periodontal membrane to the bone, to the marrow spaces or from the bone into the periodontal membrane.

G. V. Black,[7] in 1899, in describing a specimen from an old sheep, states that, owing to growth of bone, the periodontal membrane narrowed, so that the blood vessels which formerly had been in the periodontal membrane were now in the bone.

Thus, it is clear that, in one case, marrow spaces may become spaces in the periodontal membrane, and in another case, the spaces in the periodontal membrane may be converted into spaces in the bone.

These interchanging processes are normal physiologic phenomena and must be taken into consideration in studying pathologic findings.

6. The sections shown in Figures 5 and 6 were furnished the author by James L. Zemsky, New York City.

7. Black, G. V.: Fibers and Glands of the Peridental Membrane, Dent. Cosmos, 41:101 (Feb.) 1899.

SOME FUNDAMENTALS OF AMALGAM TECHNIC*

By R. C. SEIBERT, D.D.S., St. Louis, Mo.

IN discussing once more the use of amalgam alloys in dentistry, it is not my intention to cover all the history of the amalgam filling. However, a very brief review of a few of the outstanding facts in the evolution of this phase of dentistry may be of interest, especially as far as they concern the most important contributions of the greatest workers in this particular field of research.

About 125 years ago, "fusible metals" were first used in filling cavities in teeth. A few years later, mercury was added to the alloys in order to lower the fusing point. While the mixture thus developed was not a success, it marked the origin of the use of amalgam as a material for filling teeth.

The real introduction of amalgam in the United States occurred in 1833. The circumstances under which amalgam was first employed in this country and the subsequent results of its early use were for many years a matter of decidedly unpleasant record. For about fifteen years, controversies occurring within the profession over the use of amalgam, the so-called "amalgam war" of 1840-1855, did not tend to improve in any way the status of the practicing dentist.

Finally, about 1861, serious scientific study of amalgams was undertaken. Experiments were conducted to test contraction, expansion and the physiologic effect of the use of amalgam on the system. In the three succeeding decades, numerous significant discoveries were made, but the exact status of amalgam remained uncertain until the appearance in 1895-1896 of the results of G. V. Black's important studies of the "Physical Characters of the Human Teeth in Relation to Their Diseases and to Practical Dental Operations, Together with the Physical Characters of Filling Materials."

Dr. Black collated known facts and studied them rationally; and, as a result of his labors, alloy making and manipulation were for the first time placed on a scientific basis. The crowning achievement of his more than forty years of skilful study was the standardization of alloys for dental amalgams. By combining in proper proportions the expanding element, silver; the contracting factor, tin; the stabilizer, copper; the toughener, zinc, and the uniting solvent, mercury, an amalgam was produced which could be depended on to set hard, offering a high degree of resistance to pressure, without expansion or contraction.

With amalgam thus placed on a rational, scientific basis, after almost a century of chaos, it remained for another great research worker, Arthur W. Gray,[1] to contribute substantially to the

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 21, 1928.

1. Gray, A. W.: Metallographic Phenomena Observed in Amalgam, J. N. D. A., 6:513 (June) 1919.

improvement of amalgam technic. Gray's experiments were concerned chiefly with resistance of amalgam to crushing stress and with the dimensional changes taking place in amalgams during the period of manipulation. These tests were conducted on a highly scientific basis by the use of carefully constructed instruments, and the results were calculated with mathematical precision. As a result of his experiments, Gray determined, among other things, the following important facts:

1. The best results are obtained when the time of packing does not exceed two minutes.

2. If the time of trituration or mixing is prolonged, an excessive amount of mercury is retained in the mass, which, however, can be removed by heavy packing pressure. Owing to difficulty in applying this packing pressure, the time of trituration should not exceed three minutes, especially since hand pressure is the only means by which the excess mercury can be expressed in the mouth.

3. The age of the alloy has no effect on its stability.

4. Dimensional changes can be altered at will by varying the mercury and alloy ration, the time of mixing and the packing pressure.

The next great contributor to the development of amalgam technic was William E. Harper,[2] of Chicago. Dr. Harper perfected an apparatus for testing the resistance of amalgam fillings to air pressure. He discovered that of such fillings, as ordinarily inserted in the course of the average dentist's practice, over 80 per cent leaked under an air pressure of 4 pounds. Of the remaining 20 per cent, one half leaked after nine months under an air pressure as low as 3 pounds. These results showed that the defects in such fillings were largely due to faulty adaptation, combined, perhaps, with an improper mix. Dr. Harper demonstrated that, under practical operating conditions, with proper adaptation and mix, using high grade alloy, from 85 to 95 per cent of our amalgam fillings may be made sufficiently well to resist from 3 to 30 pounds air pressure, with increased resistance to crushing stress and flow.

In experiments which I conducted with the assistance of members of the St. Louis Study Club of Dentistry, results were secured in air pressure tests which corroborated the findings of Dr. Harper. A large number of test fillings were made by members of the club, employing a technic used by the average dentist. When these fillings were tested under air pressure, it was found that 80 per cent of them leaked. These results were reversed after the Harper technic was used. Test fillings were also made under average conditions and the results checked for consistency of hardness by the use of the scleroscope. On these fillings, also made under average operating conditions, it was found that scleroscopic readings ranged from 15 to 20. After substitution of the improved technic, with proper mix and adaptation, on fillings made under similar operating conditions, the readings showed an average range of from 30 to 34. It was also found that, when the new technic was employed, there was much greater uniformity of surface hardness. These results are consistent with the findings of Gray with reference to crushing strength of amalgam fillings. For instance, the lower scleroscopic readings indicated common defects in amalgam fillings resulting from inadequate mix, improper

2. Harper, W. E.: Amalgam Fillings, J. N. D. A., 6:1099 (Dec.) 1919.

proportions of alloy and mercury, improper condensation or adaptation and excessive or insufficient time employed for the entire operation or a part of it.

This leads us to a consideration of the prime factors which render the Harper technic so efficient in making air-tight amalgam fillings. We find that they are correct proportions of alloy and mercury, decided plasticity of the mix, tamping, packing and orderly condensation.

The proportions of alloy and mercury should be eight parts mercury to five parts alloy by weight, or enough mercury to prevent any trace of dryness, and at the same time keep the compound just short of liquid plasticity, thus avoiding an excessive dryness and too great plasticity. These proportions, when once attained by trial mixes, can be maintained ready for use by the employment of prepared capsules containing the proper amounts each of alloy and mercury.

In mixing, thorough rubbing of alloy and mercury is essential in order to produce thorough amalgamation. This is best accomplished by mixing in a mortar for the maximum time of three minutes. This time can be reduced somewhat by the use of some type of mechanical mixer to start the process, which will then be finished by hand with mortar and pestle. After the mixing is completed, the excess mercury should not be squeezed out, as has usually been done in practice, but should be left to be removed during the course of condensation of the mixture after it is placed in the tooth. There should be no crepitus in the early stages of packing.

Tamping, a process of agitation or spreading out of the material over the floor of the cavity, is done with a plugger until the amalgam is spread into a uniformly thick, dense mass in thorough contact with the surrounding cavity walls.

We are then ready to proceed with the packing or condensation of the mass. With a medium or large plugger which is smooth and slightly concave, we begin the process of packing by applying pressure at the center of the surface. With this as a point of departure, pressure should then be applied systematically by following the lines of successive overlapping circles until the cavity walls are reached. Condensation is then completed by stepping the cavity walls. This is accomplished by the use of a very small plugger which is designed to bring pressure into the angles and against all parts of the cavity walls. One complete circuit of the peripheral wall, with successively overlapping points of pressure, is sufficient. During this stage of the process, great care must be exercised not to neglect stepping well into the angles. Unless this is done effectively, some of the excess mercury will be trapped at these points, leakage resulting ultimately.

During this orderly process of condensation, the excess mercury will be forced ahead of the plugger and should be removed as it appears. The process of packing is repeated, layer by layer, until the cavity is completely filled. As the filling approaches completion, the amalgam used should be somewhat less plastic than that used in earlier stages of the operation. This result may be attained by taking the material between the fingers and expressing part of the excess mercury, care being taken to keep the amalgam in a workable mass. The margins should be covered with an excess of amalgam, and, at this point, extreme pressure should be applied with a large plugger or with the fingers for about a minute, thereby expressing the remaining excess mercury. After about three

minutes has been allowed for the initial setting of the amalgam, the filling should be trimmed and carved, to correct the occlusal and proximal form. The surface may then be made smooth by a light burnishing using soft brush wheels and pumice. The final polishing should be done at a later sitting.

In interproximal cavities, a well-applied matrix should always be used. This should be well adapted at the gingival margins, and firmly held in place by the use of ligature or a toothpick carefully wedged between the matrix and the adjoining tooth. A German silver matrix, 36 to 38 gage, is preferable to an all-copper or steel matrix. A copper matrix tends to absorb mercury and a steel matrix is not sufficiently flexible. For mesioclusodistal cavities, an all-round matrix should be used.

While a matrix of this type supplied by the manufacturers may answer the purpose in the hands of some dentists, I have always found that a matrix constructed individually for each filling of this kind produces better results. Such a matrix may be cut from material in the form of an arc, adapted to the tooth with orthodontia pliers, and then either soldered or riveted with riveting pliers. In order to obtain contact, it is best to establish separation or cut out part of the matrix at the contact point and pack the amalgam against the neighboring tooth. In my own practice, I prefer the riveted matrix, owing to the fact that the swivel joints produced by this process make it possible to pass the matrix more easily over the bell of the tooth.

The importance of contact, contour and tooth form is so great that these points should not be overlooked in an amalgam filling any more than in any other type of restorative work. The finished amalgam filling should embody the results of very careful attention to these details, since failure to give them proper consideration is the cause of numerous periodontal disturbances, such as pyorrhea, traumatic injury or gum recession. This phase of the work is, of course, a subject in itself.

DISCUSSION

J. Ben Robinson, Ballunion, Md.: The extensive use by the profession of alloy as a filling material justifies a more thorough study of its possibilities and a more careful attempt to improve a technic in order to produce better amalgam restorations. The average dentist approaches the question of alloys and their use with greater interest in the clinical phases of the subject than in the research and investigation necessary to improve the character of the finished restoration. It is incumbent on a few to delve into the mysteries which surround the more difficult phases of this subject and to work in hopes that improvements accruing to the general good will be the reward for time and labor spent. The rank and file of the profession have employed amalgams in the treatment of carious conditions of the teeth, without due regard to its rational use. In fact, owing either to unscrupulous desire or uninformed zeal, the net result of its application up to the very recent past has shown a balance in favor of its abuse rather than its proper use. Unfortunately, amalgam lends itself to abuse to such a degree that it readily becomes the retreat of the unscrupulous, the curse of the uninformed and a bane to the over-busy man, who too often accepts responsibility for an inferior product rather than devote the time, care and attention such operations require. Any further general improvement in the better use of alloys among the profession must come through a more careful choice of alloys and closer attention to details of a proven technic in manipulation. Dr. Seibert outlines the progressive improvement in the use of amalgam through study of the physical properties of alloys, attention to the detrimental properties manifested in alloys by certain combinations and a variation of such combinations to produce what is commonly referred to as balanced alloys. Dr. Black's investigation in this field forms a fascinating

story, and I am sure we all can agree with Dr. Seibert when he declares that work to be "the crowning achievement of his more than forty years of skilful study." Dr. Black's findings resulted in the introduction of balanced alloys, or alloys formed by the proper combination of silver, tin and certain modifiers to produce an alloy that would have the more desirable qualities of the component metals and would also eliminate through neutralization the more objectionable characteristics of the individual metals used. He further proved that varied conditions of manufacture caused a variation in the quality of alloy produced, pointing out that the same formula for alloys did not at all times produce identical results if manufactured under adverse conditions. He stressed the necessity for greater care in manufacture and stated that the experienced manufacturer of dental products was by long experience, best equipped to serve the profession in supplying high grade alloys. One of the serious problems confronting the operator who seeks to improve his technic in amalgam manipulation is the choice of alloys. There are many alloys on the market, each presenting more or less extravagant claims to superiority in the prominent characteristics which mark an acceptable alloy. The average dentist is not equipped with either apparatus or time to study and analyze their qualities. There is no clearing house to test their properties, and place the stamp of approval or disapproval on the product offered the dentist to encourage him in the use of the best product and to protect him from inferior goods. The Bureau of Standards has listed the principal alloys on the market and has graded them as to merit on the evidence of desirable qualities, but out of deference to manufacturers, the names of the alloys were deleted, which lessened the value of the report to the profession. Perhaps the Research Commission of the American Dental Association will some day see fit to aid the profession in this dilemma by grading alloys on the basis of scientific merit. Meanwhile, the individual operator must employ the trial and error method until he shall, through the process of elimination, come to that alloy which best suits his particular needs. The choice of alloys is a most important preliminary step in making a first-class amalgam restoration. One must know that the finished product will show a minimum of bulk change, that it will possess satisfactory edge strength and that it will demonstrate stability of mass under the stress of mastication. The success of all subsequent treatment largely depends on the virtue present in the alloy as it comes from the manufacturer. Trituration of alloy and mercury deserves more thought and attention than is usually given it. In the first place, a proper ratio of mercury and alloy used must be determined. This can be done only by trial, since different alloys require varying quantities of mercury for perfect amalgamation. It is impossible to achieve success in amalgam manipulation if one depends on guesswork to apportion alloy and mercury for each successive mix. Proportionators of dependable type should be employed and carefully used. Any one of a number of such instruments on the market may be selected, or the individual may devise one which will give proper proportions by weight, or the balance may be resorted to if it best suits the individual. Quantities of alloy and mercury should be prepared and kept ready for immediate use in order that the urge of time, in any case, will not cause haste in proportioning and possible damage to the quality of the finished restoration. Alloy and mercury may be confined in separate capsules and the contents brought together at the time of use. This more nearly guarantees not only quality in the product but also a saving of time in the operation. In referring to the research findings of Arthur W. Gray, Dr. Seibert reports: "Dimensional changes can be altered at will by varying the mercury and alloy ratio, the time of mixing and the packing pressure." Again: "If the time of trituration is prolonged, an excessive amount of mercury is retained in the mass, which, however, can be removed by heavy packing pressure. Owing to difficulty in applying this packing pressure, the time of trituration should not exceed three minutes." Everyone is agreed that the process of mixing alloy and mercury to produce an amalgam is a most important factor in securing quality in a finished restoration. The time required to amalgamate properly depends on two factors: the relative proportion of silver and tin with modifying metals which go to form the alloy, and the technic employed to secure a satisfactorily amalgamated mass. In the first case, high percentage alloys amalgamate less readily than those of low

percentage. Tin is the controlling element, and the greater the amount of that metal contained in the alloy, the more freely does amalgamation occur, and vice versa. It therefore becomes impossible to fix arbitrarily or by experiment a time limit on amalgamation that will successfully govern the operation in the use of any or all of the many alloys. It would seem that each is a law unto itself, and the particular time of mixing must be left as a factor to be determined in each case. In the second case, some device for triturating must be obtained that will take carefully proportioned masses of alloy and mercury, and, under constant work principles, with the application of the time element rationally controlled, produce an amalgam in a given period of trituration. The use of the mortar and pestle is too variable. This method is influenced by many uncontrollable factors, which makes it impossible to apply a definite time for completing such an operation, since we cannot satisfactorily control the many variables that enter into it. The nearest approach to a scientific solution of the problem is the employment of an instrument mechanically operated and scientifically controlled. The use of an eccentric to operate a bobbin or to vibrate an arm connected with it may be perfected to develop a satisfactory instrument. With the known number of vibrations of the arm per unit of time and the employment of a container with constant capacity and kneading surface for the alloy and mercury, the amount of work necessary to produce an amalgam can be definitely determined. There are some such instruments on the market at the present time, and many ingenious devices in the offices of men who, by employing the principle of trituration by oscillation, are better able to control the integrity and constancy of the amalgam used in their practices. If the investigation along lines of controlled mechanical trituration is followed up, there is every reason to believe that it will result in a positive forward step in amalgam technic. We do not believe that the last word has been spoken in the development of a better technic in the use of alloys. We do feel that great strides have been made in perfecting this universally employed filling material and look with keen anticipation to the time when such restorations will be performed with the care and precision they deserve.

John T. Hanks, New York City: Dr. Seibert's technic is, in my opinion, the minimum requirement for successful amalgam work, and, if it is adhered to, an operator can produce restorations which will be a satisfaction to himself and of lasting benefit to his patients. Carping critics of the amalgam filling are manifestly ignorant of the manner in which this valuable material should be manipulated. It would be as foolish to condemn gold because the unskilful operator could not produce a creditable inlay or foil filling. Amalgam will produce a good filling only when properly used, and the several steps necessary to proper end-result are like a chain in which each link must be perfect to have a perfect whole. I believe that many operators who adhere to former methods are making amalgam fillings that are doomed to failure, or at least are only half successful, believing that they are doing their work in the best possible way. I further believe that many students are today receiving wrong instruction. They are still being taught methods which were in vogue in the time of Flagg. Too great stress has been laid on the properties of alloys and amalgams as demonstrated by scientific tests in the laboratory and not enough stress on the manipulation of the amalgam by the dentist. Let us suppose that a manufacturer produces an alloy meeting all of the tests laid down by the Bureau of Standards. If this alloy is amalgamated and inserted in the wrong way, it will be a failure, owing to no fault of the alloy, but to the faulty technic of the operator. The manufacturers of high silver-content alloys of the present day have given us a good filling material, when it is handled in the right way. But this is not the way that we formally handled old style, low silver-content alloys. One reason for failure is that many of us have been content to follow the line of least resistance and to continue the methods in vogue years ago. Another reason that amalgam fillings have failed is that many dentists seem to be ashamed to acknowledge that they use this material at all. They will make, or will have made for them, handsome gold inlays, but when it comes to inserting amalgam fillings they seem to think that any technic will suffice. Carelessness is the principal cause of failure. A careless operator leaves decay in the cavity and under overhanging enamel walls. He does not apply a matrix in ap-

proximal cavities; mixes the amalgam too short a time, and packs it hurriedly, and without sufficient force, leaving voids and uncombined masses of mercury. He does not adapt the amalgam to the walls of the cavity in such a way as to produce tight fillings. Without a matrix, his fillings are forced into the septal tissue. He also does no carving or polishing. How can we expect this kind of technic even to approach success? I recently saw a gang of workmen installing a new heating plant in a large school building opposite the Academy of Medicine in New York. I stopped to watch them move the large boiler, which they had placed on rollers. Two of the men were working a windlass to pull the boiler into place by means of a block and fall. They would wind and wind the windlass, straining and using every effort, and the movement of the boiler was hardly perceptible. That scene reminded me of the efforts of those who, like Dr. Seibert, are endeavoring to stimulate and educate the mass of the dental profession in the correct use of amalgam. Those men who realize the value of amalgam as a tooth-saving material work and work, giving clinics, reading papers and expending as much effort as the men at the windlass, and they are rewarded by seeing the profession make an almost imperceptible improvement in their technic. But, although the windlass moved the boiler slowly, it moved it surely, so we should not be pessimistic regarding the ultimate outcome.

FUNCTIONAL POSITION CHECKBITE TECHNIC*

By C. J. STANSBERY, D.D.S., Seattle, Wash.

THE need of the general practitioner for a practical method to improve the construction of full dentures must be supplied by the introduction of a technic sufficiently simple for universal understanding, not too difficult for the average technician, not a time consumer, and still one that will give the patient the benefit of all that has to date been considered essential to proper denture construction. Each and every one of these conditions will be kept constantly in mind in presenting to you this technic, with an endeavor to overexplain rather than to leave any step or the reason therefor obscure.

In a paper read before the Section on Full Denture Prosthesis at the Annual Session of the American Dental Association in 1925, Russell W. Tench, of New York City, made the following statement: "The problem of mandibular movements in full denture prosthesis has been so involved in geometrical hypotheses that it has become totally unintelligible." This, unfortunately, was true even at that time; and, since then, more geometric intricacies have been added.

The object of this paper is to put aside all the involved problems of which Dr. Tench complains, and which properly belong to the realm of research, and substitute for them a simple, logical technic based upon and interpreting the results of the vast amount of research work that has been done. This technic does not discard nor belittle the value of this research and geometric basis, for, without them, it would not be possible. It is based upon facts of general knowl-

*Read before the National Society of Denture Prosthetists, Minneapolis, Minn., Aug., 13, 1928.

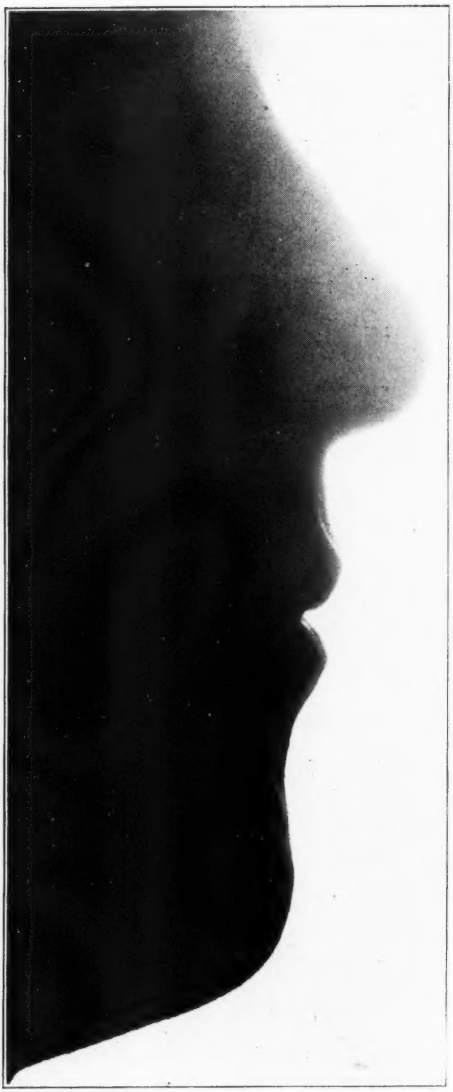

Fig. 1.—Silhouette. The requirements of a camera that will take an actual size picture are a plate or film large enough to receive the image and a bellows extensible to twice the focal length of the lens. This picture was made while the natural teeth were still in place.

edge to every dentist and is therefore more easily assimilated than a technic based upon newly acquired information. Research men must do a great deal of work the only practical value of which is to lay the foundation of a simplified technic that the rank and file may use. You will be burdened with no more theory than is absolutely necessary to make the technic clear and reasonable.

A client comes to an architect. He

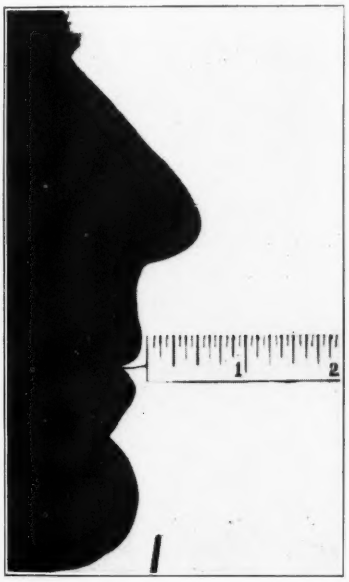

Fig. 2.—Another method of making a silhouette. If a standard sized object such as the 2-inch rule here shown is included, and the resulting picture is enlarged until the rule is true in length, the result will be the same as if the method in Figure 1 were used.

furnishes the architect with a site whose topography must influence the character of the foundation upon which the dwelling is to be built. He also furnishes the architect with ideas as to the design and requirements of his future residence. The architect proceeds to lay the correct foundation, suggests the materials most adaptable to proper construction and designs the most durable and comfortable dwelling that will conform to his client's requirements. It is no small part of his task in supplying the specifications and details to the various tradesmen and artisans employed, to see that they correlate and that each workman does his work with the finished dwelling the objective. Herein lies an analogy with the patient's presenting himself to the dentist for full dentures. The comparison of the topography of the site to the ridges and the dwelling's foundation to the denture bases is obvious. The ideas

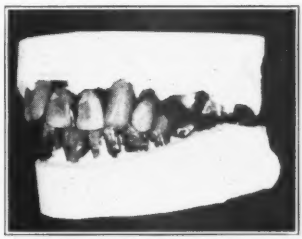

Fig. 3.—A study model cast to aid in the duplication of the individualities for esthetic reasons. Notice the closure evidenced by the relative position of the upper and lower bicuspid.

and requirements of the client may be compared to the individual jaw movements and relationships of the ridges, which are to be translated by the dentist into specifications for the denture. The denture must conform to these specifications and, like the house, be efficient and comfortable. The dentist occupies the unique position of being architect, contractor and all artisans concerned. As the architect correlates the work of the others, ever looking forward to the completed dwelling and the uses to which it is to be subjected, so the

dentist should, in every step from impression taking to finishing, bear in mind the conditions and uses to which the finished denture is to be subjected.

The major steps and their sequence, in denture construction, are of general knowledge. However, special emphasis will be placed on checkbites. Their importance in embodying this most essential information obtained from the patient and the interpretation of this information upon the instrument will receive considerable elaboration.

As in house construction, the most sensible and logical way in which to build artificial dentures is first to assemble not part but all of the specifications that are to enter in. Would you judge an architect skilful who would completely finish a house and then install the plumbing? The purport of this statement should be realized when you consider that the present method of building dentures on incomplete specifications and then vainly endeavoring to add those omitted to correct the defects of articulation due to their omission is an extravagant waste of time, with mediocre results. This is exactly what is done in the spot grinding and mouth grinding processes so widely advocated.

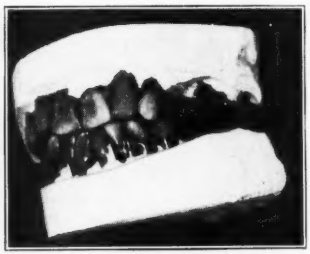

Fig. 4.—Natural opening approximated by modeling compound occlusal blocks in the molar region. These blocks are in place in Figures 1 and 2.

The first part of this paper will deal with the information that we receive from the patient; the second, the laboratory interpretation of this information. The entire checkbite technic as shown may be considered the connecting link between the patient and the instrument, a step that has heretofore received but scant attention but which is of vital importance to a successful conclusion. While this is a technic of precision, I have borne in mind the requirement set forth in the first sentence of this paper, that no step in it should be difficult and that the reasons for each step should be so obvious that you will gladly include them in your denture work. In the illustrations which are shown, the simple-

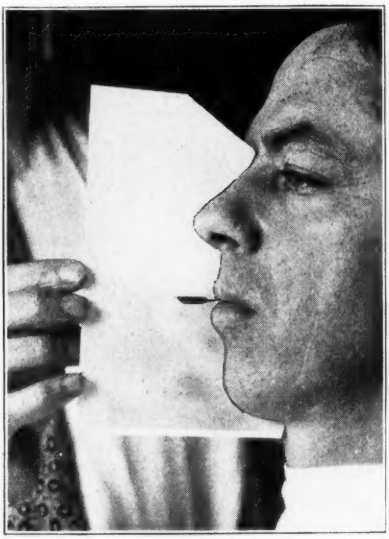

Fig. 5.—Method of using the profile pattern. The vertical facial dimension is so checked before extraction to show the patient its accuracy, at the finish of the impressions, to verify the interalveolar space; at the trying-in stage to verify proper labial contours, and at the fi..ish, to check the dentures.

articulator will be used throughout to represent the patient, when pictures of the patients themselves are not shown.

CHECKBITE TECHNIC

The first step consists in making records of the patient's profile while the natural teeth are still in place, provided we are afforded this opportunity. If a closure is evident, owing to the loss of many teeth, the natural opening can be better approximated at this time than if this measurement is left to be restored at a later time or in a step of the impression taking. To approximate this opening, occlusal blocks of modeling compound should be constructed on the remaining teeth to restore the natural

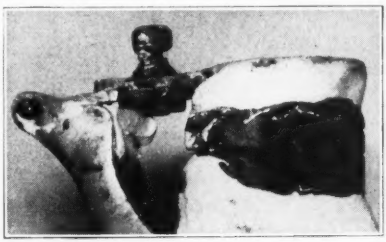

Fig. 6.—A step in the laboratory technic. The casts are set on a plain line articulator in the relation as obtained in the impression technic.

dimension; and, with these blocks in place, the patient is posed for a profile-view picture. If a closure is not evident, of course, these modeling compound blocks are not required. It is desirable, though not necessary, to have a camera that may be so adjusted that the resulting silhouette picture will be the exact duplication of the patient's profile. (Fig. 1.) With any other kind of camera, have the patient pose holding a ruler, a coin or any other flat object of standard size, directly in front of the face and in the sagittal plane. The resulting picture may then be enlarged so that the object will be true in size and, at the same time, the face portion will be likewise enlarged to its true size. (Fig. 2.) With a picture obtained by either method, the face portion is cut away, and the remaining portion placed against the median line of the face at the various steps in construction of the denture, to verify the correct position at these times. (Fig. 5.) For a more detailed description of the photographic technic, you are referred to my paper in the Eastman Bulletin, Vol. 1, No. 2. Before extraction, a bite of modeling compound or wax should be taken; and into the tooth impressions of this bite, the teeth themselves are placed after extraction. Indexed plaster blocks engaging the tooth roots are now poured. This study model, with the natural teeth, is a valuable aid in the esthetic arrangement of the artificial ones. (Figs. 3-4.)

After the extraction, we proceed with the impression taking by some technic which places the upper impression in position against the palate and ridges with a pressure at its central point. The object of this single central point of pressure in the impression taking will be seen in the checkbite technic; it equalizes the various resilient qualities of the ridges. The impression technic which I originated about five years ago[1] fulfils this requirement. On the upper stone cast obtained from this impression, accurately fitting baseplate and bite-rim are constructed. The lower impression is now taken with the closed mouth method, the patient closing as nearly as possible in what at this time appears to be centric occlusion. If any error has

1. Stansbery, C. J.: Negative Pressure Method of Impression Taking, J. A. D. A., 12:438 (April) 1925; Pacific Dent. Gaz., 36:73 (Feb.) 1928.

been made in this relation, a step later in the technic will correct it. The vertical opening is now verified by the profile pattern obtained photographically. (Fig. 5.) The verification of this dimension is of the utmost importance, as the space occupied by the upper and lower impressions with bite-rims determines the interalveolar space which the finished dentures will occupy. It should be accurately obtained and preserved without change throughout the entire denture construction.

The lower stone cast is now made and, with the upper cast, mounted on a plain line articulator in the relation obtained in the impression technic. The articulator is securely set to maintain this vertical relation, rigidly. (Fig. 6.) A baseplate with its bite-rim is now constructed for the lower cast. A word here on the construction of baseplates: Baseplates made of the stiff, high heat materials furnished for this purpose do not give sufficiently accurate impressions of the cast. A baseplate so made may have but a few points in actual contact on the hard cast, and when transferred to the mouth, these points may rest upon highly resilient tissue, allowing considerable movement. A flexible metal tray is burnished to the cast and lined with one layer of wafer modeling compound. This is warmed and an accurate impression is taken of the cast. It should be in detail what the finished denture made from this same cast will be. This is done because we are to subject this baseplate to the same conditions that will prevail when the dentures are finished.

The bite-rims on both upper and lower bases are made low in height to receive two curved plates, as shown in Figure 7. These curved plates are of "Monel" metal and are sufficiently strong to withstand without distortion the stress of vigorous muscle action. The upper plate, curved on a 4-inch radius, is secured to the upper bite-rim, with the convex surface downward. The lower plate, of slightly greater convexity—2½ or 3 inches—is secured to the lower bite-rim with the convex surface upward. The point of tangency of these two plates should lie as nearly as possible between the areal centers of the two casts and the plates themselves ap-

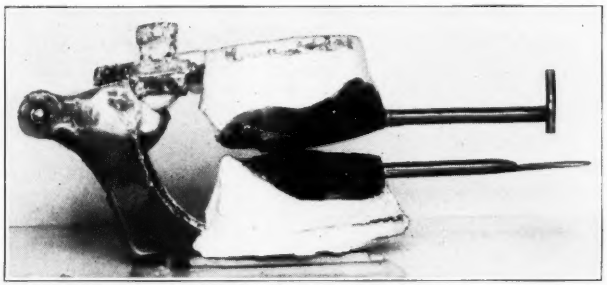

Fig. 7.—A step in the laboratory technic. The bite-rims in Figure 6 are replaced by the curved plates of the checkbite set. These plates must be in contact as shown to preserve the vertical dimension. The graph plate is smoked; the soot protected by a thin film of wax, and attached to the lower base-plate. The stylus is attached to the upper.

proximately parallel to the occlusal plane. Dr. Monson, in his researches on the spherical theory, has well established the fact that the occlusal surfaces of the upper teeth present downward at right angles to the approximately 4-inch radii of a sphere. This curvature is used so that all muscular stress against the upper curved plate may be as nearly as possible at right angles to its surface for all lateral and protrusive positions of the mandible. George P. Phillips, of Boston, was the first to describe a tripod supporting a single point

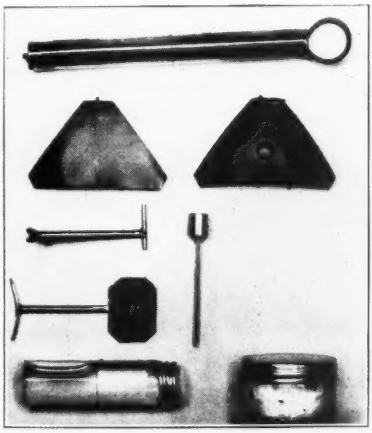

Fig. 8.—Checkbite set. (For the use of these parts refer to Figures 7, 10, 12 and 13.) It is more convenient to pour the mixed plaster into the syringe than fill by suction. The two measuring glasses assure the proper proportions for consistency and time of setting.

against a flat upper plate for the purpose of equalizing the pressure on the ridges, but partially reintroduced the error he endeavored to correct by the wedgelike action of modeling compound which he forced between the rims in making his record.

In the lower plate at the point of tangency, a round-headed screw threaded in millimeters is inserted from the under side. Each full turn raises its head above the upper surface 1 mm., and therefore forces the curved plates apart. (Fig. 8.) This round-headed screw, in its raised position, takes the place of the cusps in the finished denture and acts to force the mandible into a position below that of centric occlusion while in the protrusive and lateral positions. This screw, normally flush with the surface of the lower plate for the correct vertical dimension of centric occlusion, may be raised to any degree to separate the plates for the requirement of the particular case at hand in accordance with the cusp height of the teeth being used or the overbite deemed advisable. While still mounted on the plain line instrument, the tracing-pin, or stylus, and smoked graph plate are attached to the labial surfaces of the bite-rims as shown in the illustration. (Fig. 7.) The stylus and smoked graph plate is a modification of Dr. Gysi's attachment for registering the gothic arch and establishing centric occlusion. Credit for the extension of this device, thereby magnifying it and making it more readable, belongs to F. M. Hight, of Houston, Texas. In this checkbite technic, the tracing by the stylus on the smoked graph plate is no integral part of the checkbite. All the relations which we seek are contained in the checkbites themselves, and the only function of the tracing is to make the various positions of the mandible readable to the operator. The objective of this checkbite technic is to register the relationship of the upper and lower ridges in the exact functional positions which they will occupy when the dentures have been completed. To do this, more than the protrusive and lateral ex-

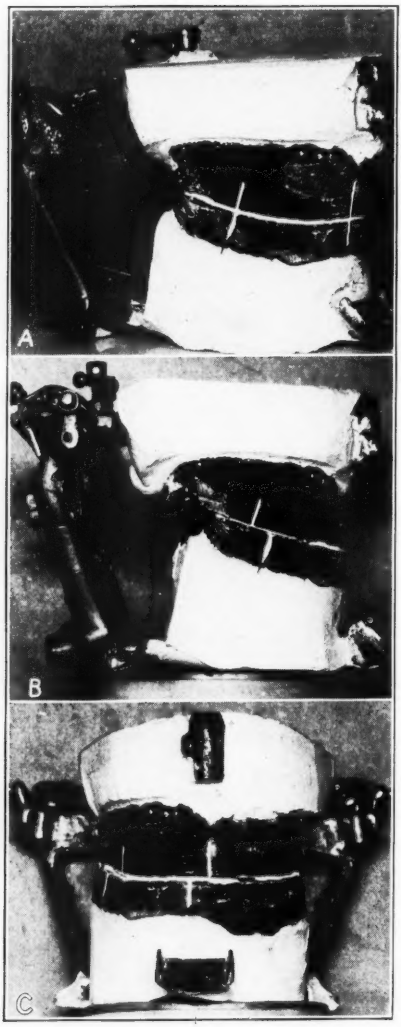

Fig. 9.—Method commonly used with bite-rims. *B* and *C* show the two relations which the mandible cannot assume on account of cusp interference. Why register these impossible positions?

cursions on a horizontal plane from centric occlusion must be given consideration. In each of these excursions, the modifying influence of cusp height must also be registered. (Fig. 9.)

The next step is at the chair. The baseplates and bite-rims are placed in the mouth with the curved plates in contact, or the screw in its lowest position. (Fig. 10.) These highly polished surfaces are lubricated with cocoa butter to eliminate all friction, which makes it impossible for one plate to exert any horizontal force upon the other; vertical force only can be exerted. This condition will be further explained in the analysis following the technic. The patient is now instructed to maintain a constant, moderate biting force and put the mandible through movements of protrusion and retrusion. From the retruded position, the patient is asked to move the mandible first to the right, to return to retrusive position, and then to the left; all these movements being recorded by the stylus on the smoked plate. (Fig. 11.) These recorded movements have nothing to do with the technic other than to proclaim to the operator the position of the mandible; and his only task is to look at them and understand what they mean. If the retrusive position affords also the correct centric relation, the two movements, one to the right and one to the left, will record tracings, both beginning at the retrusive point and forming an angle with each other. The design will be an arrowhead outline, or gothic arch. Once more, the patient is asked to assume the retrusive position, which is to be verified by the stylus being at the exact apex of the arrow. While it is held perfectly still in this position and under a moderate biting force, a quick setting mix of plaster of Paris is injected into the space

between the curved plates. (Fig. 12.) A solution of one part of saturated solution of potassium sulphate and one part water, used with "plaster No. 1," to give an initially watery mix, is very satisfactory for this purpose. (Fig. 8.) Sufficient plaster should be used that the checkbite produced is a double concave disk. This is the registration for centric occlusion. In lectures, at this point, I am often asked if these tracings are not hard to make. Usually they are very easily made, but occasionally we have a patient with but little voluntary control, and it then requires some watchful waiting on the part of the dentist while the patient makes the tracings. Even so,

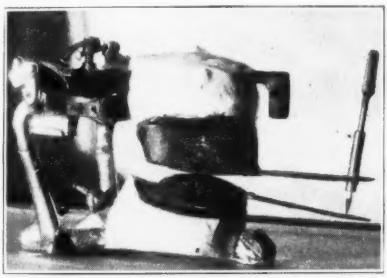

Fig. 10.—Simplex articulator representing the patient. The baseplates and checkbite are set in the proper position for the registration of centric relation.

these tracings are the hardest part of the technic; so we graciously allow the patient to do them for us.

The baseplates are now removed from the mouth and the screw is elevated to represent cusp height. They are again placed in the mouth and the movements before described are repeated. (Fig. 13.) The cusp height introduced between these plates will cause the arrow design to be advanced on the smoked plate, usually about 1.5 or 2 mm. (Fig. 11.) The patient is asked to close in a lateral position so that the stylus lies exactly on one of the lines describing the arrowhead, one quarter inch from the apex; and while under the same biting force as before, plaster is again injected between the curved plates. The quarter inch of lateral movement from the apex is necessary for a movement of one eighth inch in the first molar region, which is the distance the buccal cusp of the lower molar travels laterally to come into apposition with the buccal cusp of the upper molar in assuming the position of working bite; the molar teeth occupying a position half way from the center of movement to the tracing. This procedure is now repeated for the opposite side. The fourth and last, or protrusive relation, is determined when the stylus

Fig. 11.—Tracing on the smoked graph plate.

lies in a position directly back of the apex at a distance equal to the overjet which is to be built into the dentures. (Figs. 14 and 15.)

Our information is now complete: the registrations of the four major positions of the mandible—centric, right and left excursions, and protrusion—and it must be noted that we have dealt with nothing except the positions of the alveolar ridges. Condyles and condyle paths have not been mentioned; opening axis and axes of lateral movements have also received no attention. Bennett movements, various orientations, rotation points, quints, lateral shifts, the face-bow, occlu-

sal plane, compensating curve, curve of Spee, basic lines, anterior components and the naso-optic-condylar triangle are conspicuous by their absence. Many other terms have been omitted, terms invented in good faith to describe some phase of anatomic geometry, whose understanding was thought necessary to the proper construction of dentures, but which served only to complicate and con-

Fig. 12.—Method of plaster injection.

fuse. Again referring to the first sentence of this paper, I have endeavored to make this "sufficiently simple for universal understanding."

An analytic résumé of the procedure to this point is now opportune. The object of the face profile, to verify proper interalveolar space, is evident. (Fig. 5.) The taking of the impressions under the same condition of pressure and direction to which the dentures are to be subjected should not require further comment. To analyze the checkbites, it is necessary to give some thought to the condition of the tissues underlying the baseplates. The resiliency of this tissue, and especially its horizontal mobility, have been the principal sources of trouble in the accurate registration of the jaw positions with the methods commonly in use. A review of the technic thus far completed will bring to the attention the fact that this tissue has been subjected to but one single direction of force, and that is the vertical direction. One of the outstanding features of my

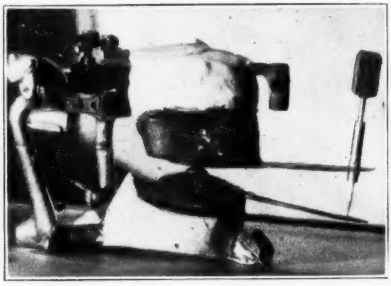

Fig. 13.—The screw raised to represent cusp height for the registrations of the eccentric relations. (Compare Fig. 10.)

technic is the elimination of resiliency in the vertical direction by pressure, and the elimination of horizontal movement by the lubrication of polished points of contact to avoid horizontal force. To illustrate: Clinch your fist and select the back of some finger that may be comparable to the edentulous ridge, and exert a slight pressure vertically of, say 4 ounces. Note the amount of tissue compression. Increase the pressure to 1 pound. Note the added compression, if any. Now 2, 4, 6, 10 pounds, noting the lack of further compression as pressures

are increased. Your reason and sense of feeling will tell you that the compression was practically complete at 1 or 2 pounds and that further increase in pressure met with practically solid, unyielding resistance. But even under these heavy vertical pressures, the addition of a slight horizontal force will cause a wide range of movement. A condition similar to this combined vertical and horizontal stress is found under the baseplates where methods are used allowing the baseplates to exert horizontal force upon each other. All the methods of grinding in bite-rims or taking tracings on them by rubbing one against the other are open to this criticism.

Mr. Hanau and his disciples, recognizing that centric and eccentric relations were matters of precision, and not being able to obtain two alike for the same patient when pressure was applied on bite-rims, evolved the idea of taking these relations when rims were barely in contact—zero pressure, as Drs. Wright, Sears and French refer to it in their writings. This procedure is open to two criticisms. First, in the construction of the bite-rims themselves, some slight pressure is necessary, and the protrusive thrust in closing has a horizontal element tending to tip or slide the baseplates on the resilient ridges. Also, in making these bite-rims, we have no assurance that the force is properly distributed on the bases because the bulk of bite-rim material and unevenness of heating cause different degrees of resistance over which we have little control. The second and most important criticism is that centric occlusion being the position of the greatest masticating force which takes place at the termination of each masticating stroke, the position of the bases, while riding but lightly upon the ridges, or zero pressure, will not be the same as their position under this masticating stress. Errors of articulation need not concern us while patients

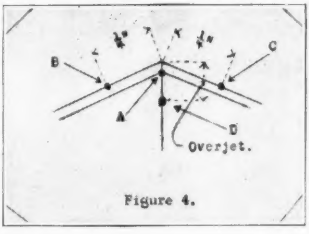

Fig. 14.—Diagrammatic sketch of the tracing on the graph plate with the positions of the stylus indicated by *A*, *B*, *C* and *D*, for the four major functional positions of the mandible.

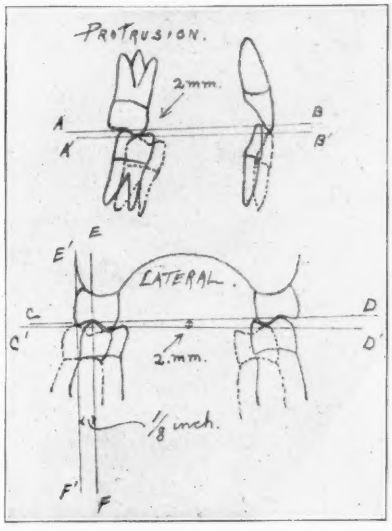

Fig. 15.—Teeth of a finished denture in eccentric relations and demonstrating the reason that the interposition of cusp height in checkbites is imperative. The measurements given apply to the deep cusp, mold 133. The 2 mm. should be reduced in using teeth of lesser cusp height.

keep their mouths open. Our problem is the articulation under working conditions. For a decidedly pertinent analogy, refer to the picture of the soldier being measured for shoes. Why does Uncle Sam measure the soldier's feet under the condition of carrying his load? (Fig. 16.) Why is this measurement not taken while the soldier is sitting on a table with his feet hanging into plaster of

UNCLE SAM TAKES NO CHANCE ON BUNIONS
Holding pails of sand so that his feet will spread as under the weight of an army pack, a member of the Citizens Military Training Camp at Plattsburg, N. Y., is being measured for a shoe of perfect fit. —Wide World.

Fig. 16.—Member of Citizens Military Training Camp, Plattsburg, N. Y., being measured for shoes.

Paris, zero pressure as it were? A shoe made to fit the form in Figure 17 would be a misfit for the foot in Figure 18. In other methods of obtaining centric occlusion based upon a more vigorous biting into wax or modeling compound bite-rims, the inability to warm these materials in a perfectly uniform manner and the use of a bulk of the material, not the same on both sides, will cause a tipping and unevenness of pressure on the supporting ridges and displacement horizontally during closure. These discrepancies are magnified in the setting of condyle paths on adjustable instruments in which these paths are represented.

All the foregoing criticisms have been eliminated in the technic that I have described, with the nonfrictional, single point of contact between the two bases. This single point of contact insures equalization of pressure of the baseplates on their supporting ridges. The application of this principle is well exempli-

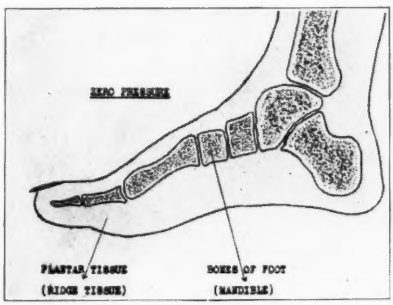

Fig. 17.—A foot with uncompressed tissue; zero pressure.

fied in the swivel bearing that is so commonly used in clamps, as illustrated in Figure 19. The mandible is sustained against the base of the skull by three points of support, namely, the two condyles and the contacting point of the curved plates. The forces that hold it in this position are the muscle forces centering around the coronoid processes. It is obvious that the two muscle forces could be represented by a single muscle of twice the strength of either, if attached at a point midway between the coronoid processes. Viewed from beneath, this point is practically equidis-

tant from each of the condyles and the contact point of the curved plates. Figure 20 shows you this view of the mandible. The two oval areas outline the muscle attachments on either side of the mandible, with the points "b" representing the centers of both muscle forces. As the mandible, by its form, may be considered a solid body, the same result would be obtained if a muscle were attached at the point "B," exerting a force equal to the sum of the other two. If "B" be considered the muscular force which is drawing the mandible upward, it is obvious that the mandible is supported against the base of the skull on a tripod

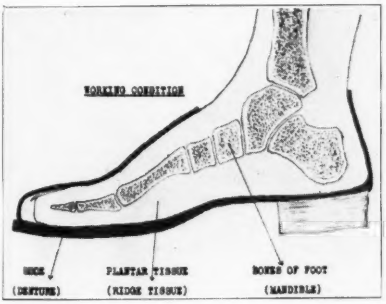

Fig. 18.—A foot under normal working conditions. A study of this figure and Figures 16-17, with no other argument, should convince one of the necessity of taking checkbites under working conditions.

consisting of the two condyles and "C," the point of contact between the two curved plates. This puts the entire mandible in the same state of equilibrium against the base of the skull as are the individual baseplates on the alveolar ridges. (Fig. 19.) Followers of Dr. Monson hold that it is quite important that the tissue within the glenoid fossae be normally compressed during the taking of proper checkbites. Others hold that the compression is so slight as to be negligible. Be that as it may, the condition existing in the glenoid fossae will be truly recorded by this method of registration.

Thus far, we have analyzed the conditions affecting the taking of the checkbites. Now give attention to the plaster disks, or the registrations. These records contain the individuality of the patient's movements, modified by absolutely no external restriction nor influence. Everything that had any bearing on the patient's particular movement was allowed to exert itself and was registered in these plaster disks. So, in these little disks, we see the convergence of the many and various elements contributing to the functional positions of the mandible.

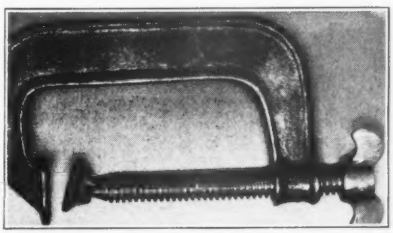

Fig. 19.—Illustrating a principle that can be applied to both baseplates against the ridges during the taking of checkbites and the tripod support of the mandible against the base of the skull.

A résumé of the information we have obtained from the patient covers: 1. Correct vertical dimension of interalveolar space. 2. Correct centric occlusion verified by the gothic arch, taken at the correct vertical dimension under the biting stress; equalization of the resiliency of the ridges and elimination of horizontal displacements. 3. Lateral and protrusive relations all under the same conditions as above except that the vertical dimension has been increased to accommodate cusp height. With an in-

strument that will duplicate these maxillomandibular relations with fidelity, we are in a position to arrange teeth that will function in the mouth as they function on the instrument.

INSTRUMENT

The ideal dental articulator would be one that exactly reproduced all the movements and positions that the patient's jaw might take during mastication. Unfortunately, such an instrument exists only in that patient's mouth. We have said, reproduce both movements and positions; we can reproduce on the instrument only such information as we receive from patients through their checkbites, and that is, records of positions, not movements. The patients hold a position while we make the record; if they move, the record is spoiled. The movement from one position to another on an instrument is not a matter of record from the patient, but an arbitrary straight line, mechanically controlled, from one recorded position to another recorded position. Fortunately, the variance of this straight line movement from what the actual movement might be is usually so slight as to be within the range of the patients' adaptability. This variance they will conform to and establish as their habit.

The distinction between movement and position leaves us only positions to study in our dental articulators. This makes it necessary for us to inquire into some of the underlying facts concerning positions; facts which, when thoroughly understood, will greatly simplify articulator problems. As all positions are relative, to fix the position of any single point in relation to any starting point, we usually locate it by three measurements, two in the horizontal plane and one in the vertical plane. It is thus seen that it takes three measurements to fix a single point. The number three carries on throughout this paper as a symbol of stability. We have called your attention to the three measurements necessary to stabilize a single point, and to stabilize any body, three of its points must be fixed. If a single point in the

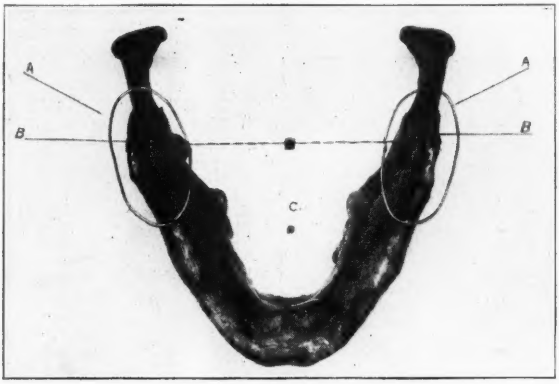

Fig. 20.—*A*, area of muscular attachment. *B*, center of muscular force. The center point is the resultant of the forces of the two sides (*A*+*B*), *C*, point of tangency of the two curved plates.

body were fixed, the body could revolve about this point as a center in all spherical movements. If two points were fixed it could then revolve around a line drawn from one fixed point to the other, describing a complete circle; but if the third point is fixed, the body then becomes stabilized in one position, and no movement can take place without moving one or more of these three fixed points. You will recall that, during the presentation of the checkbite technic, the mandible was described as a tripod supported on the base of the skull.

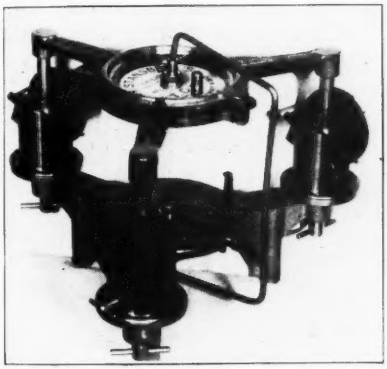

Fig. 21.—Functional position articulator.

Only one other consideration of the mechanics of an articulator need be given: what constitutes universal direction? If it were possible for the center point of a sphere move to any point on the sphere's surface, we would say that this point could travel in a universal direction. Any point on the sphere's surface could be located by direction in degrees on a horizontal plane through the center of the sphere and by degrees of elevation or depression. This shows a close relation between universal direction and stability. Many simple devices of universal direction exist, with which we are familiar. The surveyor's transit instrument is mounted on a horizontal bed that can be rotated through an entire circle, and at any point, the telescope can be elevated or depressed to any angle. The nozzle on a fire-boat is capable of the same universal range. Un-

Fig. 22.—Universal device.

derlying both of these examples and also the universal device on the articulator is the same principle: complete horizontal rotation in combination with complete vertical range. As a résumé up to this point: To understand an articulator, you must understand the stabilty of a tripod, or a body with three points

of support, and the ability of a telescope to point in any direction.

Apply the conditions of stability to a milking stool. The three points where the legs rest on the ground are the three points of support, maintaining a fixed position of the stool on the ground. No movement is possible without disturbing one or more of these points. As an illustration, to be used in explaining the instrument, we will further consider this milking stool. Two milkers take turns at the same milking. One milker uses the stool close to the cow, while the other one wishes the stool back a few inches. When he moves the stool, he does not lift it and then set it down, but drags it back so that each leg of the stool leaves its track on the ground. We now have a way of replacing the stool exactly in its first position by simply moving the legs back in the tracks which they made. While this is all very simple, more than just knowing it is necessary. These facts should be so well established in our habit of thinking that their mechanical reproduction is apparent on our first glance at an articulator.

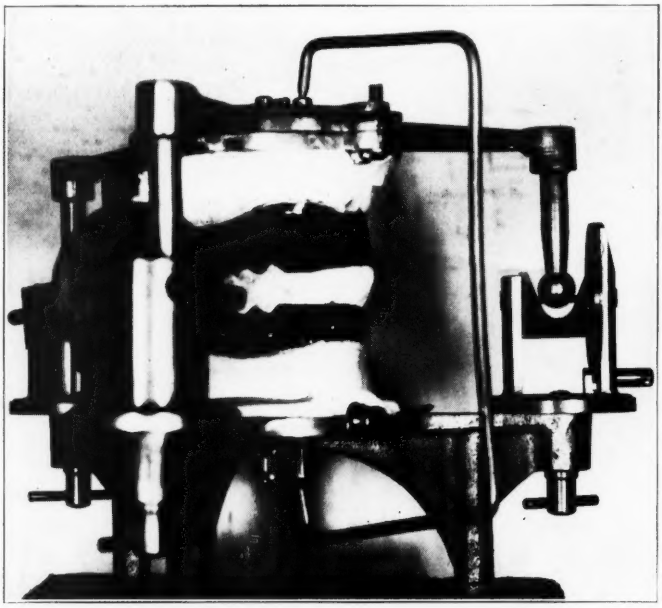

Fig. 23.—Universal device. The space under the ball exists in the other two devices. This assures the cast's being in correct relation without any guiding interference of an instrument. It is one of the important points of the entire technic.

Having separately described a milking stool and universal direction possible for a telescope, I shall now combine them in describing the articulator. The upper part of the instrument is a plate, for the attachment of the upper cast, supported by three legs. This plate has a vertical range of 2 or 3 mm. as a

working convenience in grinding the teeth to articulation and plays no part whatever in the adjustment of the instrument or the relation of the casts. Spherical steel balls form the ends of the legs. In this assembly, we now have a "milking stool." The lower part of the instrument is likewise a plate, for the attachment of the lower cast, with three universal direction devices placed exactly under the three legs of the upper portion of the instrument. Technically, the vertical axis of the device passes through the center of the spherical ball. If a telescope were split lengthwise and the upper half removed leaving a groove or trough, we would then have represented the construction of the universal direction device on the instrument. The groove in the device has a curvature to fit the ball and is equipped with a stop which allows the horizontal axis on which the groove swings also to pass through the center of the ball. (Figs. 21 and 22.) This arrangement of the balls at the intersections of the vertical and the horizontal axes allows the devices to be rotated either in a horizontal or a vertical plane and the grooves to enjoy universal direction without disturbing the position of the balls. A record of these rotational movements can be made from graduations on dials that are part of the devices.

Our next step is the utilization of the checkbites. These checkbites contain the individuality of the patients themselves. It is here that we endow our inanimate instrument with life. This is the real connecting link that brings harmony between the exacting individual requirements of our patient and the perfection of our denture service. With an adjusted instrument, we may consider that we are working with the patients themselves, as far as mechanical means will permit. The base of the lower cast is indexed and, with its baseplate and curved plate, it is mounted on the lower portion of the articulator in an advantageous position for setting up the teeth. Onto this lower curved plate, the upper baseplate, with its curved plate, is put in position by means of the centric occlusion checkbite and the upper cast placed in the upper baseplate. The upper portion of the instrument is now attached to the upper cast with plaster of Paris. The accurate construction of the instrument directs the legs of this upper portion exactly into place in the grooves of the universal devices at the intersections of the axes. When the plaster attaching the casts has set, the position of centric occlusion as established by the checkbite is maintained by three points of support, and, as explained in a previous paragraph, this position will continue to be maintained even though the direction of the grooves in the devices are changed. This position represents the marks made by the legs of the stool in the position used by the first milker.

Raise the upper portion of the articulator and replace the plaster checkbite of centric occlusion with the plaster checkbite of a lateral excursion. The upper cast, and with it the entire upper portion of the instrument, when placed in this checkbite, has assumed an entirely new position in relation to the lower. The balls no longer occupy their rest positions at the points where the two axes of the universal devices intersect but have moved to new positions. In Figure 23, a spring clamp holds the casts in proper relation with the checkbite interposed; also, at this time, the devices have been so loosened and moved that the balls are free from any contact with the grooves. This perfect fitting of

the checkbites with no instrument interference nor influence is a very important step in the precision of the position of the casts. Too much emphasis cannot be put on this step of the technic. It is quite a different thing whether you accurately fit the casts in their relative positions and then make the instrument conform to this position or whether you maneuver an instrument into such a position that the casts will seemingly fit the checkbites. In this reversal of the logical sequence of technic, many errors may be hidden. The assumption that such an instrument is capable of being so maneuvered in itself may be an error.

The three devices are now moved around their horizontal and vertical axes until the balls are in contact with the bottoms of the grooves and set to maintain these positions. The lateral checkbite just used represents the wishes of the second milker, and the positions of the balls in the grooves represent the marks left by the stool where he used it. He made the track for its return to the first milker's position by dragging the stool. We made our track by adjusting the grooves to contact with the balls in the new positions. We have brought each groove into a position as a track to let the ball slide back to the position that it occupied in centric occlusion. The instrument will now hold the casts in centric occlusion and lateral occlusion and give a straight line movement between these two correctly recorded points. A memorandum of the readings on the dials is now made for this lateral excursion. The procedure as outlined is repeated for the opposite lateral excursion and its memorandum made. Likewise, protrusive adjustments are made and recorded. You have by this time probably noticed that this instrument is different from those with which we are familiar in that it controls but one movement at a time. This is not a fault but a virtue. It is much better to have separately reproduced these movements between correctly recorded positions than to have all in combination and none exactly right. Neither does this complicate, but rather does it simplify the correct setting of the teeth.

Previous to mounting the casts on the instrument, the upper plate is lowered 1 mm., one turn of the knurled nut. Before beginning to set up the teeth on the casts, we raise the nut 1 mm. The result will be that teeth set in contact at this position will be 1 mm. too long for the correct vertical dimension determined early in our technic. This 1 mm. is slowly closed as the teeth are ground to establish balance, with the result that we have ground into a correct vertical height rather than beginning at a correct vertical height and grinding out of it. With the instrument set to move from centric to protrusion, the teeth are set up and balanced for the protrusive or incisive bite. In protrusive balance, only the mesial aspect of the lower cusps and the distal aspect of the upper cusps are involved in contacts. From an average spherical 4-inch set-up, changes only in anteroposterior curvature and, by tipping the teeth forward or backward in the sagittal plane, will be necessary to obtain this balance. Referring to the memoranda made, we readjust to the lateral movements and, by buccolingual tilting, secure balance for both lateral occlusal positions. These three movements should now be ground with an abrasive powder as the upper plate is gradually lowered 1 mm. as previously referred to. Remove the stone casts, preserving an index on the instrument for their replacement. The indexed surfaces of the casts are protected

by tinfoil or cellophane when the cases are flasked and, after vulcanization, are dry-cooled. They are carefully removed from the flasks, remounted and reground to correct errors of vulcanization. For this last step, I am indebted to Dayton D. Campbell, of Kansas City, for the suggestion. He also advises the use of Austin's stone for this procedure. With careful vulcanization and finish, we should place such dentures in the mouths of our patients and do no mouth grinding whatever.

CONCLUSION

As a conclusion and review, I shall correlate the edentulous ridges with the casts on the instrument by comparing both to a natural balanced denture. The occlusion of the natural teeth maintains a normal distance between the mandible and maxillae, which we have referred to as natural opening or correct vertical dimension. In the checkbite technic, this vertical opening is preserved by the correct height of the bite-rims, verified by the photoprofile pattern. This vertical height of the bite-rims is further preserved on the plain line articulator by placing the curved plates in contact and is so carried through to their placement on the instrument.

When the natural denture is in correct centric occlusion, the condyles are normally in their most retruded position. From this position, movement to either side compels a forward movement of the opposite condyle about a center in the general location of the condyle on the side toward which the mandible moves, the centers thus changing as the mandible passes the median line. With the graph plate and the stylus in place, this change of center is indicated by the angle formed at the point of the arrowhead tracing. In the articulator, this change of direction is reproduced by the rotation of the universal devices in their horizontal planes.

With the natural denture, lateral movements are accompanied by a lowering of the mandible sufficient to accommodate the cusps of the natural teeth. In the checkbite technic, this same depression of the mandible is brought about by interposing cusp height with the screw between the curved plates. This lowering of the mandible is accomplished on the instrument by the upward inclination of the grooves. The same reasoning concerning cusp height is true of protrusion as of lateral excursion. The duplication of the position of the mandible is the same in all three: natural denture, edentulous ridges with curved plates and cusp height, and the instrument with the casts in which the eccentric positions are taken to conform to the adjusting guides. The technic has carried through a degree of precision which makes it possible for these teeth that we have visualized in a natural balanced denture now to be transposed to the casts on the instrument and be subjected to the same movements to which they were accustomed on the natural mandible and maxillae.

While this entire paper has been written in reference to full dentures, the same fundamentals of position are true in all technics of reconstruction. Given accurate casts of the natural teeth and equally accurate checkbites of the masticating positions, it is possible to construct and finish on the instrument extensive bridge restorations in perfect balanced occlusion and with the assurance that they will function in the patient's mouth as we have designed them.

The ultimate object in using a dental articulator is to reproduce the positions and mechanically imitate the movements of the natural ridges in their counter-

parts, the casts. All mechanisms, geometric hypotheses and methods of mounting, with their accompanying maze of theory, are but means to this end. I have here shown a short cut to this desired goal that has sacrificed none of the exactness which the most elaborate technics could possibly give. The development of this sequence of procedure has been forced on me. A few years ago, in the use of bite-rims for checkbite information, I discovered that the discrepancies in checkbites were so great that adaptable instruments, supposed to be adjusted with precision, showed a wide range when adjusted by different sets of checkbites from the same patient. This forced my improvement in checkbite technic. With such accuracy in checkbites as I have shown you, restrictions in the movements of adaptable instruments became evident in that the instruments could not be adjusted to fit the checkbites. This, in turn, made it necessary to construct an instrument which is fully adjustable to any position that a checkbite might exact. Fortunately, this progress has not led us into further complications but has shown us a simple technic for a simplified problem.

ANESTHESIA FOR CHILDREN*

By E. F. SULLIVAN, D. D. S., Boston, Mass.

SIR William Osler, addressing the Canadian Medical Association at Montreal in 1902, placed anesthesia as first of the three most benign gifts granted the human race since the great Titan stole fire from the heavens. In passing, the other two are: sanitation and antisepsis.

Since a Boston dentist, Dr. Morton, successfully demonstrated a practical administration of anesthesia at the Massachusetts General Hospital, Oct. 16, 1846, volumes have been written on anesthesia.

Anesthesia as defined is no respecter of age. It is therefore obvious that a single paper on "Anesthesia for Children" must necessarily be confined to generalities.

At the outset, let me say there is no "best anesthetic" under all conditions. Several operators may obtain the same satisfactory end-results, each using a different anesthetic. The choice depends entirely on the operator's judgment, skill and experience. All must consider the physical condition of the patient, the preparation of the patient and the nature of the operation, as to the duration and the postoperative effects. The anesthetics that we have at hand are well known to all present: ether, nitrous oxid and ethyl chlorid are outstanding general anesthetics. The local anesthetics are, procain, ethyl chlorid and another which I shall refer to later.

Before taking up anesthetics proper, the question of premedication should be considered. The medical profession has

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 23, 1928.

been giving recognized anesthetics since 1846, and has found it desirable to give morphin, atropin and other agents in order that the induction of the anesthesia may be more smooth. In pedodontia, premedication for the administration of an anesthetic is not frequently indicated. If premedication is indicated, chloretone is probably the best for the average child. When nitrous oxid is to be given to a known epileptic, phenobarbital U. S. P. (luminal) has proved advantageous. While suggestion cannot be exactly termed premedication, all children should be mentally prepared for any anesthesia. For example, if procain is to be used in the nerve block or conductive method, explain to the child the new and peculiar sensations that they are about to experience, such as the puffing or ballooning of the tongue and lips. For nitrous oxid, if an aeroplane trip to France or the South Pole is suggested, it invariably facilitates the administration of the anesthetic and proves a delightful experience for the majority of patients. Walter Dill Scott, president of Northwestern University has said: "While tradition regards all humans as wholly logical, the more modern conception makes him largely a creature of suggestion."

Taking up briefly the general anesthetics of interest to the pedodontist, ether, being the oldest, is the best known. It is used most satisfactorily with our hospitalized patients. Let me say here that, in pedodontia, hospitalization of patients is indicated more often than is generally realized.

Ethyl chlorid, while used for many years under various modifications and names, is primarily an institutional anesthetic. The anesthesia produced is of short duration and is frequently accompanied by hysteria. Because of its low place on the list of general anesthetics as to safety, ethyl chlorid has not gained widespread favor in private practice, while, at the Forsyth Dental Infirmary for Children at Boston, last year, ethyl chlorid was administered 8,668 times, nitrous oxid six times and procain 2,890 times for the extraction of 27,512 teeth. As a general anesthetic, ethyl chlorid is not rapidly gaining favor even among oral surgeons.

Nitrous oxid is unquestionably the safest and most popular general anesthetic used in the private practice of pedodontia today, owing largely to the untiring efforts of J. A. Heidbrink, who directed the attention of anesthetists to the standardization of all factors entering into dosage. He also coupled these factors with a technic all portions of which are obligate, if one is to reach the highest degree of routine success. With the present anesthetic equipment, it is possible to duplicate all factors of a gas-oxygen dosage for children. The reason is, I believe, that children live a more nearly uniform life than adults, so that they respond similarly to anesthetic influence within age groups. Children 10 years of age will normally come under the influence of nitrous oxid in 1 minute and 30 seconds; the child-group at 12 years responds in 1 minute and 35 secons; those of 14 years, in 1 minute and 40 seconds. Very young children have in common a low basal metabolism, unstable reaction, incompletely developed nervous system, high pulse rate and narrow anesthesia range, all of which contribute toward a general masking of symptoms. Symptoms develop with startling rapidity and intensity, though fortunately, the very factors which contribute to the seemingly threatening situation may be the best means available to avert real danger. Children

respond very quickly to oxygen ventilation and their high pulse rate favors tissue ventilation.

While it is common knowledge that nitrous oxid is contraindicated in some cases, few children are addicted to morphin, cocain or alcohol, and we, as pedodontists, have but to consider two types: (1) the exceptionally high-strung, nervous child, who seldom responds well to nitrous oxid, and (2) the natural red-head; very few of whom arrive at a normal state of anesthesia.

To the pedodontist giving general anesthetics, the thymus gland is of grave importance, so grave that the Massachusetts General Hospital, Boston City Hospital and the Children's Hospital of Boston made it a fast and hard rule that no child under 12 years of age should be given a general anesthetic without a roentgenogram showing a negative thymus. Incidentally, a negative condition of the thymus may be produced by two roentgen-ray treatments or one radium application, administered by a competent physician.

Passing on to local anesthetics: procain, both in infiltration and conductive anesthesia, or nerve block methods are used extensively. For children over 8 years of age whose confidence you are sure you have gained and can hold, nerve block anesthesia may be successfully accomplished, provided the child is mentally prepared for the peculiar sensation which accompanies this method. Children should not see the syringe or the passing of the needle through the flame. They should be told in such language as they will understand, what to expect, such as the puffing or ballooning of the lips. The use of block anesthesia is entirely a matter of judgment on the part of the operator as to the psychic reaction of the patient. Procain infiltration also requires careful preparation of the child. For deciduous teeth, an injection of the peridental membrane buccally and lingually has proved extremely satisfactory, cauterizing with phenol and inserting the needle just under the gingival margin or gum flap and forcing the solution in advance of the needle along the roots of the tooth. Anesthesia of a limited though sufficient area is produced in from two to four minutes.

Ethyl chlorid as a local anesthetic is of little or no value. The pain resulting from the application of the anesthetic is more severe than that of the proposed operation, in most cases.

Without delving into child psychology or oral surgery, may I suggest a form of anesthesia that gives a most satisfactory result in selected cases. This method is offered not to supplant the use of any of the anesthetics before mentioned. It has, however, a large place in pedodontia. The technic of this method I shall submit for your consideration.

Deciduous teeth that are to be removed are either abscessed or have been retained over the normal time for exfoliation. At the age of 4 years, normal absorption of the roots is in progress. With this absorption of the roots, there is formed about the neck of the deciduous teeth, particularly the molars, a dense band of fibrous connective tissue. As the roots absorb, this cordlike band increases in density and clinically seems to hold the tooth in place, while there is apparently little or no attachment of the roots to the alveolar process. Anesthesia for the removal of deciduous teeth resolves itself into the desensitizing of this band and a limited area of surrounding tissue. This is accomplished with phenol 95 per cent, or even modified phenol. The technic is simple: First, dry

the area (the neck of the tooth) and lightly carry a blunt instrument covered with a film of phenol around the neck of the tooth. Use a second application of phenol, and, the third time, force the phenol-filmed instrument well toward the roots, dissecting the band of connective tissue. Two minutes should be ample for this dissection, with the suggestion to the patient that there may be a "pinching or pushing feeling to the tooth, etc." The tooth may be removed and the child's head turned over to the cuspidor and a tumbler of water given, along with a few sympathetic words. After extraction, suggestion is offered to the effect that they are glad to be free of that "dirty old tooth." Make the child loathe it as you do, and then, with a few more understanding words, all is well again. This method has proved satisfactory in thousands of cases, both in clinic and in private practice.

Pedodontia, as generally practiced today, requires anesthetics, owing largely to the advanced age of many of the children that we are required to serve. This unfortunate condition will be remedied just as rapidly as we succeed in educating all concerned with the health and welfare of children, as to the advantage of early treatment, thereby obviating the necessity of anesthetics entirely or to a very great extent. While striving for the millenium in pedodontia, we must be practical. In so doing, it is our duty to avoid all unnecessary physical or mental suffering and to be thankful that we have a choice of anesthetics.

520 Beacon Street.

DISCUSSION

S. D. Harris, Detroit, Mich.: Dr. Sullivan has very capably presented a consideration of the subject of anesthesia for children but has wisely left much to the judgment and skill of the operator. What is the best anesthetic for one very often proves a stumbling block for another. He mentioned the procedure used at Forsyth, where more anesthetics are administered to children than any place else in the world. What have they ascertained as to the best system of procedure? For permanent teeth, procain is preferred; conduction is used for the anesthesia of lower first molars, and infiltration for anesthesia of any other permanent teeth. The general anesthetics that are used are nitrous oxid and ethyl chlorid. As Dr. Sullivan stated, more than 1,000 cases of ethyl chlorid are used to one case of nitrous oxid. What are the advantages of ethyl chlorid as they administer it? 1. There is a simpler administration. 2. There is a rapidity of action and recovery that is greater than that associated with nitrous oxid. 3. There are absolutely no after-effects, if it is properly administered. 4. There is a lack of swelling of the tongue, which is quite peculiar to nitrous oxid. 5. There is a saving of material, about one-third, and an economy in the apparatus, about one-fiftieth. Lastly, there are the beneficial psychic reactions that are induced by the fact that there is a lack of fear-inspiring apparatus. I might give you an indication of just exactly how ethyl chlorid is administered as a general anesthetic at Forsyth. It might be rather an interesting little experiment. A four-fold piece of gauze is placed in the left hand, so that the two lower fingers lock the lower part of the gauze and the two upper fingers lock the upper part, and a space is left for the anesthesia to be administered. The patient has his head supported by the arm. His mouth is open and the anesthetic is administered through the mouth. The lower fingers are used to support the chin, and the upper fingers compress the nostrils so that the patient breathes of necessity through the mouth. The anesthetic is sprayed on the open portion of the gauze and the child is told to breath evenly, that it is going to be rather a pleasant experience and that he won't mind it. Very often, we put a little oil of bitter orange on the gauze, and we tell them that we are going to give them a little orange juice, especially if they are under 6, and they take it very nicely. Now they breathe regularly for about four or five long breaths, and at the end of that time, the arm, kept up to indicate muscular tension drops, which indicates that they have probably had enough of the anesthetic. That is not an infallible

rule, but it works out in about 95 per cent of the cases. This takes about thirty seconds. Ethyl chlorid is a wonderful anesthetic if it is to be used for a period of thirty seconds, no longer, within which time we can remove one, two or even four deciduous teeth, especially if they are loose. It is never used for the removal of permanent teeth, and never in any protracted procedures. In an operation that will take more than 30 seconds, ethyl chlorid is not indicated. It can be used for a longer period of time, say one minute to ninety seconds, but there are after-effects such as nausea and dizziness, that are not so pleasant. Ethyl chlorid has been used in more than 100,000 cases at Forsyth. It is administered by novices, interns who have just graduated, who have had practically no experience with anesthesia. Despite that fact, there have been absolutely no bad results from the use of ethyl chlorid. In lengthy operations, nitrous oxid-oxygen seems to be the ideal anesthetic. This is the procedure used at Forsyth. In private practice, it is modified a great deal; as it should be. Ethyl chlorid is used only in the simpler cases, only where one is positive that the anesthesia will not last over a period of possibly fifteen or thirty seconds. Otherwise, I think that nitrous oxid is always preferred. I should like to offer this one caution: No matter what general anesthetic is used, it is a good idea, as a rule, to ask the parent before administering it, whether the child has been sick at all. I learned that to my sorrow about a year ago when I tried to administer nitrous oxid to a 4-year-old who had hyperthrophy of the thymus, and who hadn't been examined. Fortunately, he survived. Since that time I have always taken the precaution to ask the mother regarding the general condition of the patient. Accidents and overdosage do occur, and I think that they ought to be mentioned. When an operator knows what to do under the circumstance, it adds a great deal to his ease of mind. Overdosage results either in syncope or asphyxia. Syncope is very similar to fainting. There is dilation of the pupils, pallor of the face, very shallow breathing, muscular flaccidity and absolute relaxation. The first thing is to remove the anesthetic. Next, tip back the chair so that the head is lower than the heart, bringing the circulation from the heart to the head. Then administer artificial respiration and stimulants if necessary. The stimulants suggested are amyl nitrite or spirits, and now they are using a great deal of caffein sodium benzoate, which seems to be quite good. Asphyxia is very similar to syncope, except that it is usually due to mechanical blocking, probably mucus stuck in the throat, swelling of the tongue, dropping back of some gauze or some other form of mechanical blocking. Under the circumstances, there follows an increasing cyanosis and a jerky difficult breathing. Remove whatever it is that happens to be blocking the respiratory tract and then continue with exactly the same procedure that is used for syncope: first of all, removal of the anesthetic always; secondly, restoration of the oxygen; and thirdly, administration of stimulants if necessary.

R. N. Douglas, Elkhart, Ind.: This is a very important subject because there is no other phase of our service in which we have almost as much fear as the patient does regarding the work, particularly when we have to administer the anesthetic by the local method, which most of us have to do if we do not employ the nitrous oxid method or do not have it accessible. I was particularly interested in what Dr. Sullivan had to say and the last suggestion that he made, that we get our patients early enough so that we do not have to use means of removing the teeth. If we can save the teeth, we shall be able to avoid this disagreeable phase that all of us have to face. It is particularly disagreeable because usually we have the mother and the father as well to deal with. Perhaps the child has been told about the work or it has been talked about at home, and the suggestion to the child that he is going to be hurt is very disagreeable. The mother and father come in with as much dread as, or even more, many times, than, the children. If you did not have to deal with that phase of it, if you could always leave the mother or the father out of it, you could often get along very easily. I like to get a child at the age of 2 or 3 years when I can fill the little cavities and take roentgenograms and check up for interproximal fillings. We are not yet at a stage in children's work where we are always able to do this. I would like to report a case with a view to getting some information from Dr. Sullivan. I failed utterly in the case. A deaf and dumb boy about 10

years of age, came to me a year ago just a day or two before they were going to send him to a school in Indianapolis for deaf and dumb children, and at that time, he needed to have several teeth extracted. The deciduous teeth, were, in the vernacular, "shot to pieces." But the parents delayed having the work done at that time. They did nothing for him at the institution, and I wonder that they even took him at the institution with his teeth in that condition because, in most of the institutions, they demand that the teeth be placed in good condition before the child enters. The patient came back again this summer, and I had the extraction work to deal with. Before attempting it I did the filling and the prophylactic work, and got along very well. When I came to the extraction work I suggested to the father, that if I could use nitrous oxid anesthesia I would much prefer it in preference to a local anesthetic under the conditions. Consider for a moment that you cannot reason at all with such a child. Dr. Sullivan spoke considerably of suggestion, but it cannot be applied here. Such a child cannot understand what you say. This patient understands lip movement a little better now than he did a year ago, but we could not tell him what we were going to do. He knew that we were going to extract his teeth and he was very much afraid. There is more fear I think, in a child who is thus shut out from the outside world. I attempted to do the work under local anesthesia because the mother disapproved of using the nitrous oxid. The doctor with whom I was associated had given the boy ether twice, and they had had a great struggle at that time. I did not get far with the local anesthesia. The patient rebelled. Perhaps a more experienced person, perhaps one who has dealt entirely with children as Dr. Thomas has, would have been able to handle the situation. I then made arrangements to use nitrous oxid afterwards, but the mother still refused, and I do not know what the outcome of it will be. The child still has the bad deciduous teeth, which I think will be a menace to his health sooner or later. They are even now because he is not properly masticating his food. I should like to ask at this time what you would do, Dr. Sullivan, under these circumstances. I never had a similar case before in my practice. What do they do with a case like that in an institution where they have to work for children? General practitioners are not equipped temperamentally to handle children and should not handle children. One dentist in my town made the statement to me that he hated children, that he hated to see them come in. And yet he is attempting to work for children and trying to do something for them, and he fails, of course. It is only a half-way procedure, and he is doing more injury for the child than if he had not tried it at all. You have to be equipped temperamentally. As Dr. Thomas told us this morning, you have to love these children, and have a personal interest in them before you can do proper work for them.

THE DECIDUOUS TEETH*

By WALTER L. HYDE, D.D.S., Minneapolis, Minn.

THE man who can view a perfect set of deciduous teeth without "amazement and admiration" as C. S. Case used to say, or who contemplates a set of deciduous teeth distorted by malocclusion and wrecked by caries without a pang of sorrow that is real pain, has no proper place in the dental profession. So cunning is the arrangement and so fine is the adaption of these beautifully designed and capable units to the needs of the developing human being that nothing short of millions of years of evolution could have produced it.

PRENATAL FACTORS

A consideration of the deciduous teeth may properly begin with prenatal conditions. Certainly it is quite generally agreed that if anything of importance is to be done to improve dental health generally, it is necessary to begin with the mothers. Bones and teeth are largely calcium, and if it is true that as a people we are "calcium starved," how dare we expect anything but the very problems that confront us continually? It is not enough that there be a sufficiency of calcium: it must be balanced with other elements, and conditions must be right for its absorption and assimilation. Unfortunately, the dentist or orthodontist has comparatively little opportunity to establish contact with possible dental problems at this stage, and the physician who is on the case frequently has trouble enough without looking so far into the future.

The various ills of pregnancy, errors of diet, vagaries of appetite, lack of exercise or pernicious nausea may, and probably always do, have more or less effect on the future dental development of the child. These are critical weeks, and much of the child's future health and well-being depends on the condition of the mother.

Inherited constitutional factors are of the utmost importance. As well expect to grow prize corn from poor seed as to expect good teeth and jaws from much of the parental stock that comes under our observation. It is probably along this line that we will find the answer to the frequent question as to how large a part heredity plays in our problems. These factors are receiving more consideration from physicians than formerly.

It is a peculiar fact that, in spite of the many difficulties encountered, hypoplastic enamel markings are comparatively rare on the deciduous teeth. Anything like the formations on the labial surfaces of permanent teeth so frequently encountered are hardly ever seen on the deciduous teeth. I do not know the explanation of this. It may be brought out in the discussion. The enamel defects usually observed are in

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the nature of wide fissures on the occlusal surfaces of molars or defects on the edges of the incisors.

The principal effect of rickets seems, as far as we are concerned, to be evidenced on the bony structures that support the teeth. Sometimes, it seems that an affliction of this sort, which is almost without symptoms or other mark, leaves the jaws in the condition of susceptibility to any adverse influence that may appear. The so-called "spongy boned" child is the one who develops malocclusion as the result of mechanical forces perverted in habits, such as thumb sucking, mouth breathing and bad posture, either sleeping or waking.

Major difficulties such as tuberculosis and syphilis of course produce untoward effects, but we are more commonly asked to deal with the result of bad nutritional conditions, and especially rickets. It is indeed fortunate that it is fast becoming common practice for mothers to engage the services of the pediatrician regularly, and that the knowledge of the virtues of sunlight and cod-liver oil is so widespread.

TEETHING

Teething is a normal physiologic process and should give rise to no pain or ill-health. When disturbances do arise, it is well to look farther than the teeth. Probably every ill known to childhood has been blamed on the teeth, and often is yet. This has worked untold harm to children, and once again we have to thank the pediatrician for a more scientific handling of the child's troubles. To allow a diarrhea, for example, to persist for weeks with the statement "Oh, he's teething" is little short of a crime. When all other possible factors have been eliminated and teeth still seem to cause a disturbance, there is little to do but regulate the diet and keep the mouth clean. It is rare indeed that the use of the knife in the mouth at this age is proper.

The first tooth usually comes at about six months, though sometimes children are born with teeth and sometimes the appearance of the first tooth is greatly delayed. There can be quite a variation from what is commonly considered the normal time without its being particularly significant. If this variation is more than a few months, one should look for some fault in the nutrition or suspect some constitutional factor. When dentition is slow and the reason is not known, it is quite safe to advise sunshine and cod-liver oil.

The deciduous dentition of twenty teeth should be complete by 2½ years. It is the duty of every dentist and orthodontist who comes in contact with a young mother to inform her as to the number and the care of baby teeth. If more mothers knew how many teeth there are, it would mean the salvation of more first permanent molars. A good way to impress the matter on the mind of the mother is to state that there are just as many teeth as there are fingers and toes.

Both missing and supernumerary teeth occur in deciduous dentition and are often the cause of malocclusion and impaired function of mastication or of the lips. No general rule can be given, but usually extra teeth should be removed and space maintained where teeth are missing. Such variations as these are often repeated in the permanent denture, and in the study of a problem of this sort, the roentgen-ray should always be used.

Some English authors[1] think that

1. Northcroft: Teeth in Relationship to the Growth of the Jaws, Dental Board of the United Kingdom, 1924.

there is an absolute relationship between the sizes of the first teeth and their successors. This I have not observed to be true, though occasionally a child with unusually large deciduous teeth will have large permanent teeth. As a matter of fact, there is not a great deal of variation in the sizes of teeth in the children here in the Northwest. Nearly always, in my practice, a child with teeth of unusual size comes here from some other part of the country or from abroad.

OCCLUSION

Much less attention has been given to the details of occlusion of the deciduous teeth than to that of their permanent successors. Normal development, however, shows such remarkable adaptation of parts that it is a most interesting matter for study. Friel has applied Hellman's method of study to occlusion of the deciduous teeth and considers it under four headings: (1) surface contact; (2) cusp and fossa contact; (3) ridge and embrasure contact, and (4) ridge and groove contact.

1. Surface Contact. — The lingual surfaces of the maxillary incisors and cuspids overlap the labial surfaces of the mandibular incisors and cuspids and a part of the first molars.

2. Cusp and Fossa Contact.—The lingual cusp of the maxillary first molar occludes in the main fossa of the mandibular first molar.

The mesiolingual cusp of the maxillary second molar occludes in the central fossa of the mandibular second molar.

The distolingual cusp of the maxillary second molar occludes in the distal groove of the mandibular second molar.

The mesiobuccal cusp of the mandibular first molar occludes in the division between the maxillary cuspid and first molar.

The distobuccal cusp of the mandibular first molar occludes in the central fossa of the maxillary second molar.

The mesiobuccal cusp of the mandibular second molar occludes in the central fossa of the maxillary second molar.

The distal cusp of the mandibular second molar occludes in the distal groove of the maxillary second molar.

3. Ridge and Embrasure Contact.—The triangular ridge of the distobuccal cusp of the maxillary first molar occludes in the embrasure between the mandibular molars.

The triangle ridges of the mesiolingual cusps of the mandibular molars have no contact with the sides of the embrasure that they oppose, which probably saves the child from biting his tongue.

4. Ridge and Groove Contact.—The triangular ridges of the mesiobuccal cusp of the maxillary first molar occludes in the buccal groove of the mandibular first molar.

The triangular ridge of the mesiobuccal cusp of the maxillary second molar occludes in the buccal groove of the mandibular second molar. (These are most helpful points for observation when first examining the little patient.)

The triangular ridge of the distolingual cusp of the mandibular first molar occludes in the lingual groove of the maxillary first molar.

The triangular ridge of the distolingual cusp of the mandibular second molar occludes in the lingual groove of the maxillary second molar.

The oblique ridge of the maxillary second molar occludes with the distobuccal groove of the mandibular second molar.

CARIES

The deciduous teeth are very susceptible to caries. A combination of poor structure, wrong diet and lack of care will often cause almost a complete wreck of the temporary teeth before the age of the first permanent tooth, a bad start in life that means greatly impaired dental health and more or less trouble as long as any of the teeth remain. Another great factor is lack of vigorous function. Teeth are certainly to be used for chewing and biting. Modern diet with soft food and an abundance of free artificial sugar is anything but ideal. It seems unfortunate that the use of such natural sugars as occur in honey, figs, dates and other fruits is so comparatively restricted when the consumption of refined sugar runs over 100 pounds for each person per year in this country.

Regular prophylaxis should be commenced when the child is small and should be continued. For a very small child, the use of a piece of clean cloth around the mother's finger is satisfactory. A little later, the child can have his own toothbrush, in an appropriate size. It has been the fashion recently, in some quarters, to criticize the toothbrush but, admitting some of the faults with which it is charged, the fact remains that many patients are benefited by its use. Eternal vigilance is the only policy with regard to caries in the deciduous teeth, and no cavity however tiny is too small to be filled. The dentist who for one reason or another does not want to be bothered with the child and says, "Oh, that's too small to fill," has done an untold amount of harm and caused the loss of many teeth with all the ensuing unhappy effects. The pulpal walls of deciduous teeth are too thin to permit of extensive cavity preparation or are too thin to protect the pulp properly when cavity preparation is possible. The best answer to these things is prompt and early treatment so that large cavities are avoided.

If, unfortunately, large cavities do occur and contacts are lost, there will be a collapse of the arch unless restoration can be made by some such combination of inlay and overlay as suggested by Willett,[2] which permits a maximum of restoration with a minimum of cutting. If teeth are lost, much future trouble and orthodontic treatment can be avoided by making splints or space maintainers. In most cases, these can be simply made with bands or overlays and rigid bars. In some instances, the more elaborate types with broken joints, presumably to permit certain growth to take place, are indicated, but simplicity is advisable as a rule.

It would hardly be possible to place too much emphasis on the necessity of preserving the vitality of the deciduous teeth. It is common observation with all of us that the roots of a nonvital tooth do not absorb properly. This was proved by Luciani[3] of Paris, who examined a very large number of such teeth.

This absorption is a rather mysterious process. Many children who seem to have fair vigor in the development of the new tooth are quite unable to absorb the roots of the deciduous teeth. Much help can be given these cases by judicious extraction, the operator always, of course, being guided by the roentgen-ray findings. Sometimes, for

2. Willett, R. C.: Inlay Restoration for Deciduous Molars, Dent. Items Int., 50:345 (May) 1928.

3. Luciani: Bull. Acad. de Med., Paris, May, 1927.

example, all that is necessary to prevent a misplacement of the permanent cuspid is to extract the deciduous cuspid.

MALOCCLUSION

Malocclusion of the deciduous teeth is much more common than formerly thought. The old conclusion was undoubtedly due to lack of sufficient careful observation, and it was not until Dr. Bogue began his studies that these conditions received their deserved attention.

Mathews[4] has observed that "malocclusions in permanent dentition must be inevitable if any irregularity of the occlusion is present in the deciduous dentition." This is true, and the slightest variation from normal is therefore worthy of observation and consideration. There are many factors that might be against very early treatment, but if occlusion alone could be considered, the only requirement is a positive diagnosis that things are wrong. Probably the commonest variation from normal is the lack of sufficient width of the upper arch, especially between the upper cuspids. A child with a good quality of bone and a good tone to the muscles may work his own way out of this, where the child with "spongy bone" and poor muscle tone seeks an easier way to bite or does not bite at all, and the mandible is found in either a mesial or distal relation or the width development is at a standstill. More extensive records of measurements and models will be very helpful in considering these things. Delabarre[5] has accumulated much valuable material, and Lewis and his associates will have a valuable contribution to offer when their work is farther along.

The Bogue index is a reliable guide, and 28 mm. is a fair minimum measure. This measure is taken across the upper arch between the second deciduous molars at the gum line. If this is found to be 28 mm. or less, between 5 and 6 years, it is positive evidence of an arrest of development, regardless of the alinement of the deciduous teeth.

When upper teeth are found posterior to their normal relation with the lower teeth, treatment is indicated at once. When there is an excessive overbite, it is again indicated, unless some general physical condition contraindicates it. In other cases, where the variation from normal is not so great, it is often advisable to observe the case and select the time for treatment. Each case must be determined on its merits and action must be contingent on the consideration of many factors.

When treatment is undertaken, the appliances should be as delicate as is consistent with the required strength, and the forces applied should never be excessive. Simply because early treatment of malocclusion is often indicated is no reason why the child should be continuously burdened with appliances for his entire childhood. Growth is subject to times of acceleration and is certainly periodic. The wise orthodontist governs himself accordingly, and great benefit is possible by means of periodic treatment. Both Morse[6] and Willett[7] have ably considered this subject.

4. Mathews: First International Orthodontic Congress.

5. Delabarre: First International Orthodontic Congress.

6. Morse, A. L.: Internat. J. Orthodontia, 13:845 (Oct.) 1927.

7. Willett, R. C.: Periodic Treatment of Malocclusion, J. A. D. A., 15:813 (April) 1928.

CHANGE TO PERMANENT DENTITION

The change from the deciduous to the permanent dentition is a wonderful and beautiful process, and the child who can pass through this period of his dental development in harmony with Nature's plan is indeed fortunate. Charles R. Baker[8] has done considerable research along this line and presents his conclusions most delightfully.

If dentists generally understood the plan and order of this change and could inspect their little patients regularly during the critical years between 6 and 12, much malocclusion might be avoided. Of prime importance is the time element. This is more properly considered from the point of view of physiologic age rather than of chronologic age. There is a considerable range in time among individuals that cannot of itself be considered abnormal. Among the several causes for malocclusion, there are two to be considered at this time: (1) the premature loss and (2) the prolonged retention of the deciduous teeth. The former means the loss of a deciduous tooth so early in the development of the individual that the orderly process involved will be disturbed and the permanent teeth be prevented from coming into proper position. The early loss of a tooth impairs the function of mastication, which is important to the child, but of greater importance is the necessity to maintain the proper mesiodistal width for the on-coming teeth. If the teeth are lost, this space should of course be maintained by some suitable device. "Prolonged retention" means the retention of a deciduous tooth so late in the development of the individual that the succeeding permanent tooth is prevented from taking its proper position. This is controlled by judicious extraction after proper roentgen-ray study. It would be quite embarrassing to extract a deciduous molar and later find that there was no permanent tooth to take its place.

The first step in this process takes place when, at about 6 years of age, the first permanent molars erupt and occlude just distally from the second deciduous molars. If they come in properly, they establish the relationship of the two jaws and assist in holding it through the change. The second step is the erupting of the incisors. If there is not sufficient width, they have a difficult time getting into line, with the result, often, that they are rotated or overlapped, a condition which is practically always followed by more crowding, overlapping and rotation, as the other teeth try to come into an arch that is too small. The greatest width of the tooth has been attained when it is first seen, but that the greatest width of the jaw should also be practically attained at this time is not so generally appreciated by the dentist or laity. This lack of arch width may be from insufficient growth or from a collapse due to the premature loss of one or more of the deciduous teeth.

In cases of prolonged retention of either upper or lower incisors, the permanent tooth is usually deflected to the lingual side, although rarely they come to the labial. Sometimes, when the deciduous teeth have abscessed, the pressure from the developing tooth causes absorption in such a way as to separate the root of the deciduous tooth. In such instances, the pieces should be removed.

8. Baker, C. R.: A Consideration of the Exchange of Deciduous for Permanent Teeth, J. N. D. A., 7:753 (Sept.) 1920.

Next comes the replacement of the deciduous molars, which is a more complicated process than the changes in the incisor region. The incisors erupt into an area that is bounded by the deciduous cuspids and are guided into place by the tongue and lip pressure, which is very effective provided there is sufficient width. This is probably the basis for the frequently reported case of the teeth "that were crooked but straightened themselves." The bicuspids erupt into an area that is bounded by permanent teeth, the molars having been in place about four years and the incisors nearly that long. It is a good provision of Nature that the mesiodistal width of the deciduous molars is greater than the width of the bicuspids, or the latter would probably not have enough eruptive force to come into place.

If one or both of the lower molars are prematurely lost, the contact is lost, and the tendency of the lower first permanent molar is to drift forward, while the lower anterior teeth tend to move distally or to elongate, or both. These tendencies should always be combatted with an appliance of some sort, or impaction of the bicuspids is the result. It may be noted that the developing second permanent molar will move forward also. Loss of the upper molars is not quite such a serious matter, for sometimes the occlusion will hold the upper first permanent molars in place, and, of course, the upper anterior teeth are prevented from moving distally. These cases require constant observation.

In cases of prolonged retention of the deciduous molars, we have to consider not only the successors of each one but also the opponent of each one. For example, if a lower first deciduous molar is retained too long, the upper first bicuspid may become elongated before it comes into proper occlusion with the lower first bicuspid. If the lower first deciduous molar shows no signs of becoming loose when the upper first bicuspid has erupted, it should be extracted. It is not proper to wait till the upper first bicuspid has erupted enough to come into occlusion with the deciduous molar. An occlusion between a deciduous tooth and a permanent tooth is a malocclusion.

The old idea that the deciduous molars should be kept in the mouth just as long as possible is wrong. There is a proper time for the loss of each tooth, and when that time comes, it should be removed (if it shows no sign of loosening), regardless of whether or not it appears to be a sound tooth, and without consideration of the chronologic age of the patient. When extraction becomes necessary, it should be done with proper care. The leaving of fragments of root, etc., may defeat the very purpose of the extraction.

The cuspids, the last deciduous teeth to be lost, should remain in place until nearly time for their successors to erupt. They are relatively free from caries, but are often prematurely lost as a result of the crowding in a malocclusion. When this happens, the tendency is for the posterior teeth to move forward, and we often see the first bicuspid (or the deciduous molar) almost or quite in contact with the lateral incisors. That such a condition be prevented is highly desirable. It is inexcusable to allow the impaction of a permanent cuspid just because the alinement of the teeth is good. This constantly occurs, and the parents state that the dentist passed over the condition without comment.

Prolonged retention of the cuspids often results in deflection of the permanent cuspid or even its complete impaction. In deflection, we sometimes find the absorption of the root of a permanent tooth, particularly the lateral incisor. This is a condition to be carefully guarded against by judicious extraction.

It would require but little time and little consideration, at proper intervals, to supervise the change from deciduous to permanent teeth, and if it were done, it would mean better dental health and fewer cases of malocclusion.

434 La Salle Building.

DISCUSSION

Thomas P. Ryan, Minneapolis, Minn.: The subject, "Deciduous Teeth," which perhaps evokes greater interest today than at any previous time, is still looked on lightly by many practitioners as well as the laity. Reference to the problem of inheritance and its dentitional potentialities is of such importance that we must keep it in the center of our diagnostic scheme. This paper has emphasized the value of feeding cod-liver oil which was prominently brought to our attention by Sherman W. Davis, of Indianapolis, last year. During the ten years that I have directed clinical work for children in Minneapolis, there has been plenty of opportunity for observation of results of feeding pure cod-liver oil to children with rickets and general undernourished conditions. The following treatment is used: 2 tablespoons of orange juice or tomato juice, 2 tablespoons of water, one-half teaspoon of karo syrup and 1 teaspoon of cod-liver oil. This should be given three times a day in winter, and less frequently in summer because of the fresh air and sunshine then available. It is acknowledged that calcium economy is controlled by the parathyroid, just as the thyroid controls general development. It is refreshing to hear the intelligent application of simple practical principles advocated in this paper during the "teething period" of the infant. Dr. Hyde states that "teething should give rise to no pain or ill health." Undoubtedly, before the pediatrician became such an integral part of present-day health progress, many pains in other parts of the body were unfortunately laid to "teething." Education of the parents regarding this matter should tend to remove this foolish tradition. The problem of occlusion is so thoroughly covered that we would add only the necessity for careful observation of proper spacing at 5 years of age, which, if lacking, generally means inadequate development. The statement that "the deciduous teeth are very susceptible to caries" is amply borne out by experience. This takes in problems of individual resistance, proper feeding of mother and child, prenatally and postnatally, childhood diseases, heredity, etc. The point has been forcibly brought to your attention regarding overindulgence in highly stimulating foods and their deteriorating effect on the teeth. Some interesting research is being done at the University of Minnesota regarding childhood diseases as they affect the teeth. We are constantly looking into mouths with hypertrophied and infected tonsils. H. A. H. Bouman, a Minneapolis surgeon, persistently reminds me of the fact that enlarged tonsils causing mouth-breathing produce protrusion of the upper anterior teeth and because of lack of vigorous function of the posterior teeth caries increases in that region. The matter of function is very important in this age of predigested foods. Periodontists recommend the chewing of bones and hard crusts to stimulate growth without injury. The problem of premature extraction and prolonged retention are most important. Here, we need diagnostic judgment. Aside from the fact that we believe all infected baby teeth should be removed regardless of age, it is urgent where only caries exists without periapical infection to consider every possible guide: family history; law of averages governing that tooth; roentgenograms; degree of root resorption and conditions under which the corresponding tooth in the same arch and corresponding teeth in the opposing arch are erupted. If these guides are employed, considerable prolonged orthodontic treatment may be avoided. The problem of parental education is of prime importance. This may be individual, group or any of the splendid oral hygiene programs that have been in vogue in recent years. We can state with a feeling of satisfaction that parents of all classes are intensely interested today in the care of their children's teeth because of its bearing on general health

conditions. This interest has developed rapidly in recent years, which shows that our teaching has been successful. It now behooves us to render a practical service to sustain the confidence evidently aroused. Dr. Hyde states that "growth is subject to times of acceleration and is certainly periodic." The facts of this statement will be given greater thought particularly by orthodontists as time goes on, and more accurate data should, in the future, be made available through research covering the periods of most active development and succeeding periods of more arrested development as diagnostic aids. Drs. Scammon and Peyton of the University of Minnesota Medical School have done some interesting work along these lines from the standpoint of embryologic growth. Referring to the transitional period during which the deciduous teeth are lost and the second teeth take their place, we believe the question of conservation of deciduous teeth, if for no other purpose than as Nature's space retainers, is amply justified. This involves not only necessary reparative and preventive work, but also diagnostic judgment in the question of extraction governed by questions of family history in the child's development, as well as the problem of root resorption, in the detection of which we can be assisted by the roentgen ray. In clinical operations in which we have not had roentgen-ray equipment, I have found it a good plan to follow carefully the best known periods for extraction given to us by textbooks and personal observation, to be correlated with family and medical histories. I look on each child as an individual because there are always certain family characteristics, and, therefore, it is good policy to take into consideration the future of the child's mouth and not hasten the matter of extraction, although I believe in the removal of all infected teeth at all times, regardless of age, as a matter of general health. We find decayed eruption more frequent today than premature eruption. I have one patient who is experiencing her second dentition two and one-half years before the normal time. In most children second dentition is a little late. Recent research at the University of Minnesota indicates that in children here in the Northwest, the teeth erupt earlier than the periods given us in textbooks, data for which have been secured in either other sections of the country or Europe. Full mouth roentgenograms should be available to all children as a diagnostic aid and I simply tell them "You are going to have some pictures taken." I have frequently asked the question: "What about restraint in the American child?" Wonderful children, but how spoiled! We find that the foreign born, especially German children, react splendidly to dental work as a matter-of-fact procedure. The question of space retainers is all important. If your patients are readily accessible, you may measure the spaces from time to time, following necessary premature extractions, with calipers and a millimeter gage. Frequently, the succeeding tooth will appear on the horizon without the necessity of mechanical retention. The tendency is toward drifting rather than against it. I have seen complete closure of a space in a 9-year old child following premature extraction of a lower second deciduous molar, in seven months. Imagine what this means in the future shortening of the arches. Edward F. Sullivan, of Boston, in a survey of 1,192 deciduous molars in 149 children, average age, 5 years, states that 89 per cent of all pits and fissures are already decayed. Personal observation from treating many hundreds of such teeth would indicate that these figures are reasonable. We believe no cavity is too small to be filled although frequently in anterior teeth we recommend stripping the margins and applying silver nitrate, allowing decay in anterior deciduous teeth to serve as its own restoration where mechanical involvement necessary to place in a filling might bring on premature death of the pulp. The earlier operative work is begun, the better, even in the case of simple prophylaxis. I have recently placed an occlusal amalgam in a right lower molar in a 19-months old baby. Engine prophylaxis can be accomplished very successfully in small children. Light scalers, rubber cups, and small brushes can be used with a pleasant tooth paste incorporated in flour pumice. Children enjoy this work and look forward to their visits. If you have mouth mirrors with electric bulbs, although this is not necessary, they will see the difference between the appearance of the tooth before and after cleaning. Symmetrical decay has frequently come under our observation; for example, all the deciduous first molars, all first molars of the second dentition, the upper central incisors, both first and second

dentition, or the deciduous lower cuspids. Regarding enamel markings, it is generally conceded that wherever they occur on deciduous teeth, their presence has been influenced by the mother's illness during pregnancy, just as enamel is checked in the second dentition as a result of childhood diseases such as measles and the constitutional fevers. By comparison, it seems there are few hypoplastic deciduous teeth, perhaps owing to the fact that they are well developed before the usual run of childhood diseases; while the second dentition is apparently influenced by these diseases. We cannot but visualize the ideal that we feel that Dr. Hyde has in mind: thousands of children with improved conditions of the deciduous teeth. Certainly, the opportunity is ours to correct, alleviate and prevent, wherever possible, the unsightly conditions that we see in clinics and private practice, giving the child a better start in life, for many of our leading educators place health first among the requisites for a successful life; and if care of the deciduous teeth is not so important as any future oral restoration, all our talk about preventive dentistry is indeed futile.

Max E. P. Ernst, St. Paul, Minn.: I understood Dr. Ryan to say that the eruption of the teeth in most children is later than normal. I would like to know what he means by that or what his basis is for determining what is later than normal.

Dr. Ryan: Most of us have average times for the removal of deciduous teeth. In research work going on at the University of Minnesota at the present time, it has been found that in this section of the country, the teeth erupt much sooner than they do in other parts of the country or in Europe. Perhaps I should not have used the term normal, but rather, average. My experience in examining a great many hundreds of children has been, that in the average child the teeth erupt a little later than was generally supposed from the laws we have at hand. I haven't any of my own.

Dr. Hyde (closing): I am very sure there must be some confusion, for Dr. Ryan really contradicted himself in the use of the terms earlier and later. My impression is, though I have long ago discarded the tables, that our children in the Northwest get their teeth a little earlier than the average. I had hoped that there might be something more said about the hyperplastic margins. Nature in her eagerness to care for her young life is likely to rob the mother before she does the child, and unless the mother's condition is so desperate as almost to imperil her very life itself, the child is liable to come through without normal margins.

NEW FUNDAMENTALS FOR THE TREATMENT AND PREVENTION OF DENTAL DISEASE BASED ON CALCIUM UTILIZATION AND DISTURBANCE, WITH SPECIAL CONSIDERATION OF FACTORS DETERMINING WHEN AN INFECTED TOOTH BECOMES A LIABILITY*

By WESTON A. PRICE, D.D.S., M.S., F.A.C.D., Cleveland, Ohio

THE emphasis in preventive medicine is passing from repair to prevention and the next great forward movement in dental science will doubtless be effective preventive procedure combined with much more effective treatment. My studies on the relation of dental disease to systemic health, together with the relation of general health to dental disease, have continually led in the direction of the obtaining of much additional knowledge regarding the processes by which the hard structures of the body are built up and taken down in health and disease, and on the rôle of calcium in determining the functional level of all organs and tissues.

The data which I have presented[1] indicate that individuals can be classified into groups on the basis of the manner in which they metabolize or utilize calcium, and this is borne out and greatly reenforced by the continually accumulating data. Many systemic diseases are associated with extensive decalcification processes in their later stages and some in their early stages. This condition obtains in a striking manner in diabetes, tuberculosis and cancer, the individuals of which groups tend to be free from arthritic processes and quite uniformly free from the proliferative type of arthritis.

While it has been understood, on the basis of clinical data, that certain accessory food factors or physical conditions tend largely to influence the progress of changes with regard to calcification and decalcification processes, there have been few data available regarding the nature and rôle of the activators and the conditions of the body fluids which are associated with these phenomena. Since this communication is being presented in the Section which is primarily concerned with the surgical aspects of dental science, I shall present this discussion first from the standpoint of some newer knowledge developed under my direction, regarding the processes of bone growth and bone repair.

A word of explanation is probably in order as to my connection with cases of ununited fracture of parts of the body other than in the dental field. This

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 23, 1928.

1. Price, W. A.: Dental Infections Oral and Systemic, Cleveland: Penton Publishing Co., 1924; Dental Infections and Degenerative Diseases, Cleveland: Penton Publishing Co.; Systemic Expressions of Dental Infections, Am. Clin. Med., 4:943 (April) 1926.

has been entirely through invited consultation.

It is because we are dealing with the same problem, in many of its fundamental aspects, in the prevention of dental caries, the systemic phases of pyorrhea and of bone and tooth development and also of the healing of surgical lesions of the mouth, that I am selecting as an extreme phase of calcium deposition a repair process in association with fracture.

As oral surgeons, you are all directly concerned with the healing of fractures of the face. It is a matter of universal knowledge and comment that the bones of elderly people do not repair well, and presumably it is largely because of their age. Probably no site of fracture has been more difficult in which to obtain healing in elderly people than the bones of the hips and pelvis. Such a case is shown in Figure 1, in a woman 74 years of age, of excellent habits, but who, for a period of about nine months, had been an invalid as a result of the fracture of the neck of the femur. The condition of the bone before treatment is shown in *A*, at which time there was great discouragement on the part of both the physician and the patient. It was at this time that the physician asked for my assistance in undertaking to put her system into a condition in which repair of the fracture might be obtained. This assistance was given in the form of determining abnormalities in the chemical constitution of the blood and directing means for their improvement.

On studying the bones of the hip, it will be noted that there is an absence of the dense cortical layer, even on the shaft of the femur, and much evidence of decalcification of the body of the bone. In the making of successive critical analyses of the data provided in the combined blood chemical, clinical and roentgenographic studies for patients, in which more than 1,600 very extensive blood chemical determinations have been made, with particular consideration of calcium and phosphorus factors, it has continually been apparent that certain contributing factors have been very active in determining the nature and course of the abnormality. One of the striking illustrations of this has been apparent to all practicing dentists since the beginning of our science, as the development of pyorrhea with its alveolar destruction at about middle life and usually extending progressively in later life.

The evidence clearly indicates that one of the associated phenomena has been the development of a physical state in which the individual tends readily to resorb calcium from those parts of the hard structures which are highly vascularized. Indeed, the evidence is clear that the skeleton is of primary importance as a storehouse for calcium, whether the skeleton is on the outside, as a shell, or distributed through the tissue, as a framework. This woman, as is true in many elderly people who suffer from fractures, was in a state of depleted calcification, due to long borrowing from her storage warehouse for the maintenance of daily needs. I shall present evidence indicating the nature of the factors which determine whether an individual shall be required to borrow calcium for daily needs instead of obtaining the required amount from daily rations.

In the column marked I, showing the various quantities of the factors presented in the blood study *C*, Figure 1, I have presented a number of the calcium and phosphorus factors, expressed in milligrams per hundred cubic

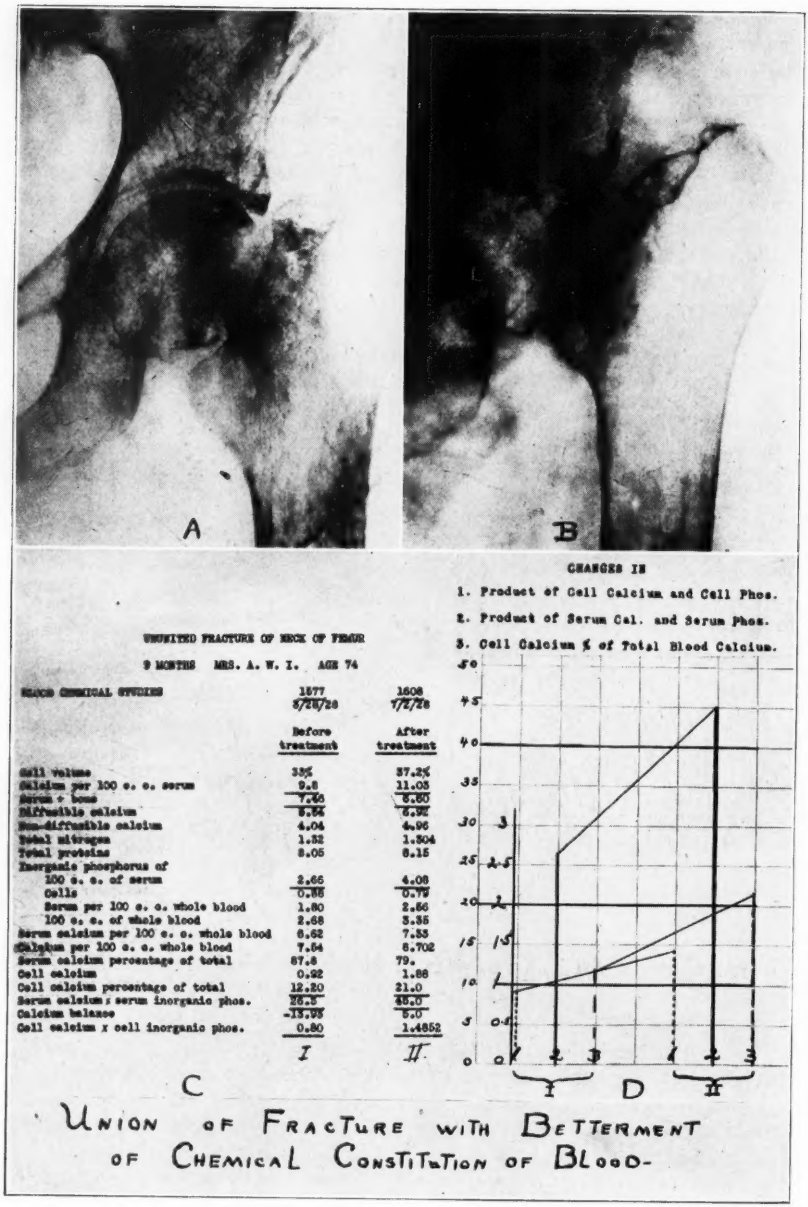


Fig. 1.—Union of fracture with betterment of chemical constitution of blood.

centimeters of blood. For better understanding of the meaning of the various quantities, I shall discuss them in order, beginning at the top, and as I do so I shall ask you to follow in Sections C and D, Figure 1, certain of these factors which seem to have a controlling influence on the behavior of calcium in the system, and it will make it more clear if we discuss comparatively the chemical readings made ninety-six days apart, one before and the other after treatment.

The cell volume before was 33 per cent of the total blood volume, from 43 to 45 per cent being normal. It will be noted that there was an improvement to 37 per cent. The calcium per hundred cubic centimeters of serum increased from 9.8 to 11 mg. We have come to recognize that total calcium may not give a very clear index of normality or of the effect of a reparative process or of abnormal demand. The item marked serum plus bone indicates that, when bone chips were placed in the serum of this patient, the calcium of the serum left the serum and deposited itself on the bone to the amount of 2.4 mg. per hundred cubic centimeters of serum, leaving 7.4 mg. of calcium in the serum (per hundred cubic centimeters). This figure is a little high for best healing, and it will be noted that, after treatment, it was reduced to 6.6.

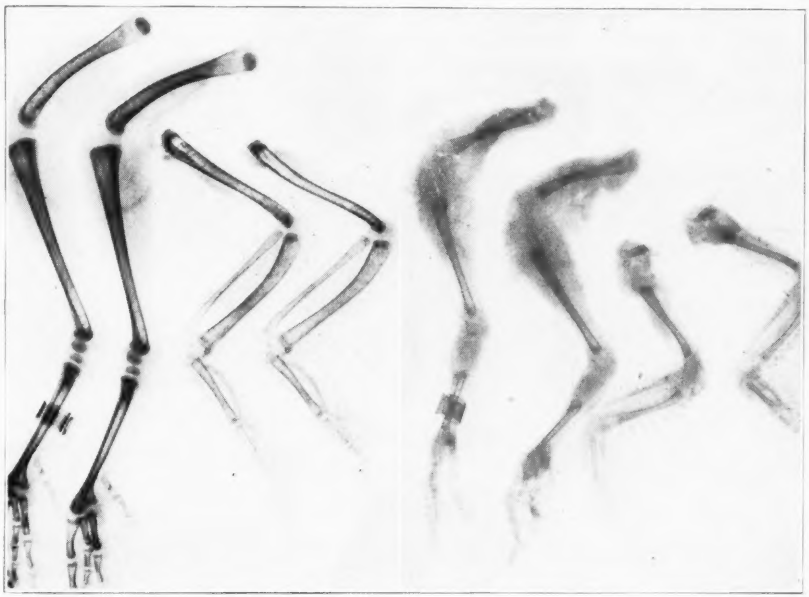


Fig. 2.—Comparison of bone structures on normal and rachitic diets.

The calcium in blood plasma and blood serum is probably present in three distinct forms. The first is in an ionized state. This will readily diffuse through animal membranes. Another part is not

ionized, and is diffusible or dialyzable through animal membranes. The third is an unionized and undiffusible form, which is probably in combination with protein. The terms diffusible and nondiffusible are arbitrary and depend entirely on the standard used. Determinations are made by adapting celloidin membranes to a state of permeability that as nearly as possible corresponds with that of animal membranes. I shall discuss in another communication the method of preparing the celloidin sacks and the degree of permeability adopted in these studies as standard. An internal air pressure of 150 mm. degree is used, which about corresponds to blood pressure. In general, going by the standards that I am using, the diffusible and nondiffusible calcium are approximately balanced in normality, with the diffusible slightly higher than the nondiffusible. This relationship has been obtained before and after treatment with an increase of both.

The total nitrogen is made up of both nonprotein nitrogen and protein nitrogen. The protein factors at 8, increasing to 8.1 after treatment, are both high. The inorganic phosphorus of 100 c.c. of serum at 2.6 is low. It increased under treatment to 4. Inorganic phosphorus of the cells is a low normal at 0.8 and remained approximately the same. Inorganic phosphorus of the serum of 100 c.c. of whole blood increased from 2.6 to 3.3. The calcium of 100 c.c. of whole blood serum and cells increased from 7.5 to 8.7.

There are certain relationships which experience and critical comparative study have shown to be desirable if not essential for normal calcium metabolism and utilization. The blood cells should contain approximately 2 mg. of calcium per hundred cubic centimeters of blood. In this individual, the cell calcium was at 0.9 before treatment and at 1.8 after treatment, an increase of 100 per cent. The blood cells calcium should contain approximately 20 per cent of the total blood calcium. In this case, they contained at the beginning only 12 per cent, but after treatment their content rose to 21 per cent.

It has been recognized for some time that the interrelationship between calcium and inorganic phosphorus is important, and that while either might vary within given ranges, the one should increase if the other decreases, and therefore their product is an important

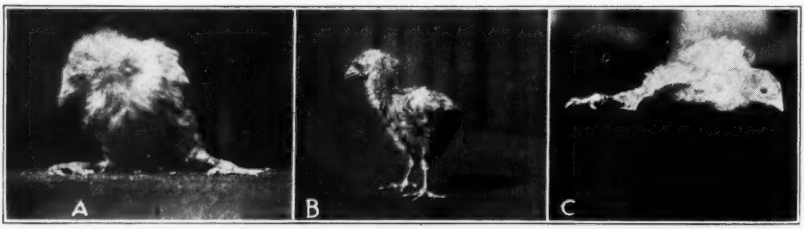


Fig. 3.—Vitamin D deficiency. Three views of same chick within nine days. *A*, appearance on high A, no D vitamin diet; *B*, three days later, on high D and high A diet, two doses of one-millionth gram of activated ergosterol; *C*, six days later (than *B*), on a diet lacking vitamin D.

expression of normality or divergence from it. This product, under ordinary conditions of adult life, should be approximately 40, but for growth conditions, whether for preadult states or the repair of injured tissues, this factor should be increased. In children, it is from 60 to 70. The product of serum calcium and serum inorganic phosphorus (9.8×2.66) was 26.1 before treatment, or 13.9 less than 40. This is frequently spoken of as calcium balance, and in this case, there was a negative balance of 13. Similarly, the product of the calcium of the cells and the inorganic phosphorus of the cells produces a figure which should be not less than 1 and should be 2 or more. In this case, this factor before treatment was 0.8, and increased to 1.4.

These three factors constitute important yardsticks for determining the capability of a blood to produce repair of a broken bone or, in fact, to deposit calcium for any and all purposes in the building and repairing of tissues and for normal organ functions. In *D,* Figure 1, I have expressed graphically these three factors. *1* shows the changes in the product of cell calcium and cell phosphorus, the groups *I* and *II* representing the condition of these three factors *1, 2* and *3* before and after treatment. *2* presents graphically the product of serum calcium and serum phosphorus, and *3,* the cell calcium percentage of the total blood calcium. The ordinates are shown in two vertical columns. The outer figures 0 to 50 relate to factors *2* and *3* in units of *5.* The inner column from 0 to 3 in 0.5 unit divisions relates to the perpendicular columns marked *1* which are the product of cell calcium and cell phosphorus. The minimum normal for the product of cell calcium and cell phosphorus is shown by the horizontal line at *1* on the inner column of figures and relates to the dotted perpendicular lines marked *1,* the product of cell calcium and cell phosphorus. The perpendicular solid lines at *2* express graphically the product of serum calcium and serum phosphorus, which should be 40 and which was 26 before treatment and 45 after. The two perpendicular columns shown with dashes at *3* represent the cell calcium before and after, the normal of which is shown at *20* in the outer column of the ordinates. This quantity increased from 12 to 21.

Associated with these blood changes, there have been very important changes in the clinical condition. The patient

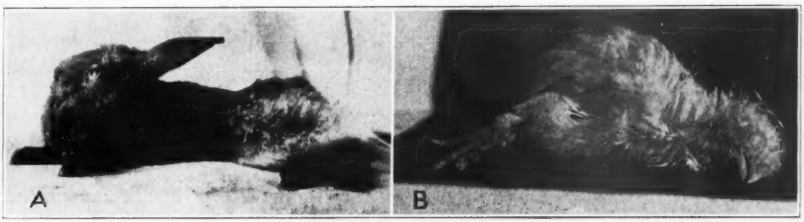


Fig. 4.—Progressive paralysis produced in a rabbit *(A)* and a chicken *(B)* apparently by an overdose of cod-liver oil. The daily quantity per body weight was approximately that often advocated for children.

has changed from a state of marked depression, with developing edema and severe prostration and helplessness, due to physical inability and pain from physical movement, to a state of progress toward normality which has been most remarkable. Though she lives in another city, I have personally seen her walk with the aid of her crutches, apparently placing her entire weight at times on this leg. The roentgenographic appearance shown in *B* clearly indicates that, notwithstanding the absence of a splint or mechanical device to retain apposition, and notwithstanding the evident shortening due to the sliding of the fractured surfaces into a position that would shorten this leg, there is marked evidence of calcification over the entire fractured area, and, further, it is easily noted that a dense cortical layer, which obtains in all normal bone, is again being built on the femur. The roentgenograms of both hips, including the heads and shafts of the femurs, show that the same change is taking place in other bones of the body and probably obtain throughout the entire skeleton.

I have given this detailed analysis of the blood chemical and physical conditions in order that we may approach in a more informed way a study of these factors which relate directly to the control of calcification and decalcification processes, for the treatment of this case was based entirely upon the results of experimental data obtained chiefly through my studies along two distinct lines, the producing of abnormal states and their correction in experimental animals and the successful treatment of abnormal clinical conditions in patients by the use of activators. The presentation of this problem by means of this practical case, with its purely surgical aspect, has been selected rather than the less spectacular but equally successful correction of dental caries.

As an additional approach to the study of normal and abnormal calcification and decalcification processes of both growth and repair, I shall ask you to note the condition presented in Figure 2, which shows in *A* the legs and wings of a normal chick and in *B* the typical expression of leg weakness in another chick, as revealed by the roentgenograms. The latter condition has been produced by a diet with high calcium and sufficient vitamin A content and low phosphorus and low vitamin D content, as shown in *A*, for comparison with a normal chicken approximately the same age that has lived its life in the open, picking its food largely from the fields, having been hatched, tutored and brooded by a mother hen. It will readily be seen that a great difference has obtained in the development of the hard structures. The epiphyses have not properly developed though some of their centers of calcification are seen as very minute structures.

Three views of the chicken with leg weakness from which *B* in Figure 2 was taken will be seen in Figure 3. In *A*, it is shown after it had been fed for three weeks on a diet high in vitamin A with no vitamin D, with the typical expression of leg weakness which that diet produces. In *B*, it is shown three days after the condition shown in *A*. On the two days preceding, it had received a dose of a high concentration of vitamin D in the amount of one-millionth gram of activated ergosterol. While its joints are still swollen, it stands erect and it could run so freely that it was difficult to catch it. In all, it received three doses only, the last one on the day that the picture was taken. During all this time, it was on the same basic diet as

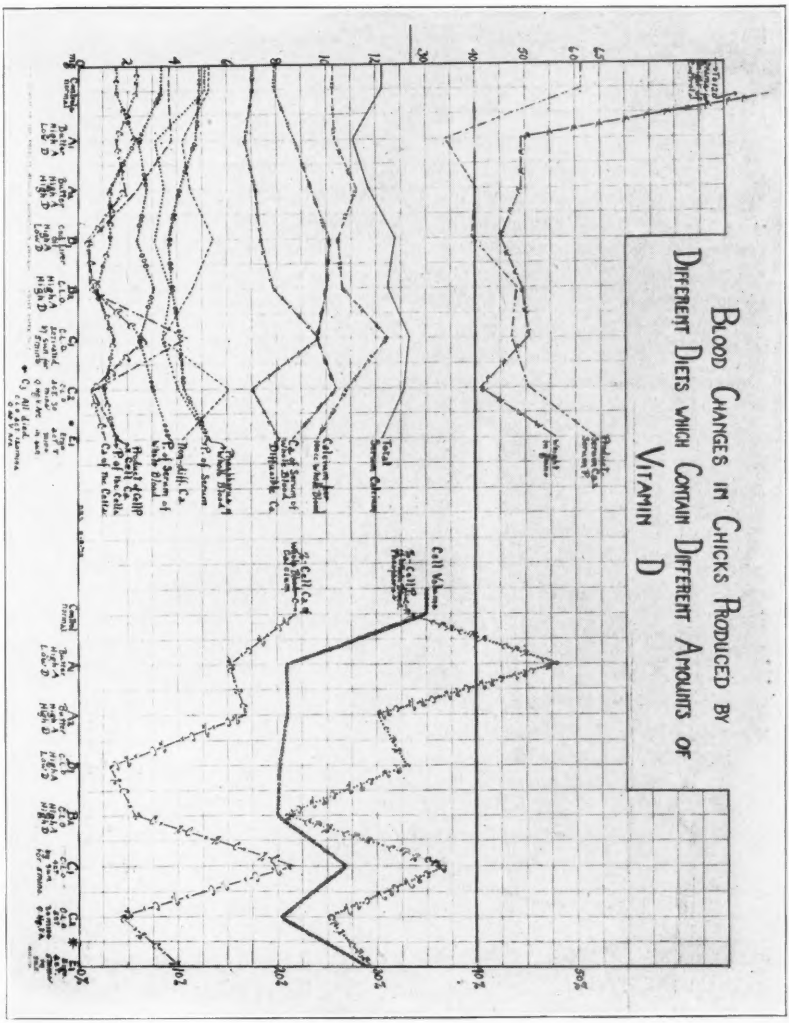


Fig. 5.—Blood changes in chicks produced by different diets which contain different amounts of vitamin D, as provided in selected butters, cod-liver oil and activated ergosterol.

in *A*. Its condition rapidly returned to that seen in *A*, but with greater prostration, and, in six days, it was in the physical state shown in *C*, owing to its being deprived of vitamin D. Two things are quite apparent: (1) that very small quantities of a high concentration of this vitamin are competent to produce a very great change and (2) that the change in the strength of the limbs is not due to a calcification of the hard structures. Calcification did not progress far enough in the three days to account for the marked improvement in leg strength. The soft tissues were, therefore, also greatly benefited by the presence of this vitamin. Some serious dangers for giving activated ergosterol will be given later.

It is important to note that all the time this chicken was under experimentation, it was kept in a very subdued light except while being photographed, and only the light from the dull ruby lamp was available for these chicks to eat by, except for the few moments when feed was being given them, when a white light through glass was used.

In several previous papers, I have presented evidence that the serum calcium as well as calcification may be greatly modified by topical applications of raw and activated cod-liver oil.[2]

The problem of the activation of cod-liver oil by exposing it to radiant energy of the proper type, and the harm that can be produced by overactivation of the oil, either from too long exposure to sunlight or from radiant energy from an artificial source, is one of great importance, and one which I have discussed in several communications.[3]

The problem of activation is exceedingly complicated, and the accumulating evidence clearly indicates that we are dealing with toxic products in either large doses of raw cod-liver oil or small doses of overactivated cod-liver oil. Several investigators besides myself have called attention to the injurious effects of overdoses of cod-liver oil on experimental animals and human beings.[4] I have frequently produced gross lesions in animals, varying in severity from hyperexcitability to partial or nearly complete paralysis. In Figure 4, there will be seen a rabbit with partial paralysis produced by the administration of cod-liver oil in a not larger quantity than has been frequently administered to children and infants. It will be noted that the rabbit's head is drawn sideways and it is unable to walk or hop. With succeeding doses, the symptoms became more aggravated. Erik Agduhr has shown by a large number of dissections that gross changes occur in both muscle and nerve tissues. We are, therefore, confronted with a difficult problem. First is the need for an adequate source of activators and, secondly, that these sources may be free

2. Price, W. A.: Calcium, Its Activation, Utilization and Metabolism, J. A. D. A., 15: 729 (April) 1928. Calcium Metabolism Studies: a. The Raising of Serum Calcium by Topical Applications of Raw and Activated Cod Liver Oil; b. Disturbances Associated with the Active Dental Caries of Childhood and Pregnancy; Am. J. Dis. Child., 33:78 (Jan.) 1927.

3. Price, W. A.: Relation of Light to Life and Health, Ind. & Eng. Chem., July, 1926; Newer Knowledge of Calcium Metabolism in Health and Disease, with Special Consideration of Calcification and Decalcification Processes, Including Focal Infection Phenomena, J. A. D. A., 13:1765 (Dec.) 1926.

4. Mellanby, E.: Brit. M. J. (May 24) 1924. Agduhr, Erik: Changes in the Heart Through the Presence of Cod-Liver Oil in the Food, Acta Paediat., Vol. 5, Parts 3-4; Changes in the Organism Caused by Cod-Liver Oil Added to the Food, ibid., Vol. 6, Part 2.

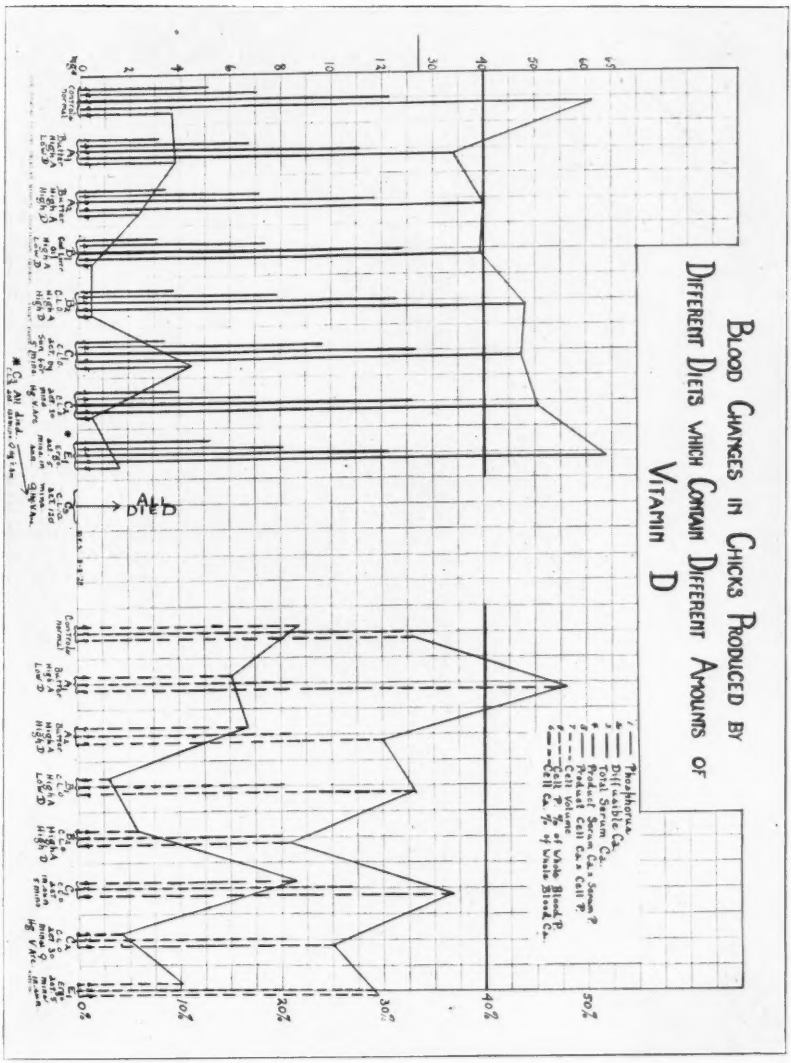

Blood Changes in Chicks Produced by Different Diets which Contain Different Amounts of Vitamin D
Phosphorus
Diffusible Ca.
Total Serum Ca.
Product Serum Ca. × Serum P
Product Cell Ca. × Cell P.
Cell Volume of Whole Blood P.
Cell Ca. % of Whole Blood Ca.
All Died

Fig. 6.—Blood changes in chicks produced by different diets which contain different amounts of vitamin D. The advantages of activated cod-liver oil in raising cell calcium and cell phosphorus are evident.

from toxic products which may do harm. In order to study this in further detail, I have used recently more than 1,100 chicks under different conditions with regard to radiant energy directly applied and with different modifications of the same basic diet by the inclusion of some of the available sources of activators. In Figure 5, there will be seen the results of a series in which the different groups received as an addition to the rachitic diet (McCollum 3143) butter, cod-liver oil and ergosterol as follows: A1, butter high in vitamin A and low in vitamin D, constituting 5 per cent of the food; A2, butter high in vitamin A and high in vitamin D; B1, cod-liver oil high in vitamin A and low in vitamin D; B2, cod-liver oil that was high in both vitamins A and D; C1, cod-liver oil high in both vitamins A and D, activated in the sun for five minutes; C2, the same oil, but activated thirty minutes with a mercury quartz lamp, air cooled, distance 20 inches; C3, the same as C2 except exposed for 120 minutes; D1, ergosterol activated in the sun for five minutes, in butter. Two chicks from each group were generally used, and the blood specimens pooled and blood chemical analyses made to determine the accumulated changes in various of the blood constituents. The weight of the chicks was also noted. Tests began when the chickens were 5 days old, during which time they had a normal diet. They were then placed on diet 3143 McCollum and 5 per cent butter or oil. All radiant energy was excluded except that which came from the subdued ruby lamp, and an abundance of food was always available, also distilled water. The experiment continued for fourteen days. There were ten chicks in each group. All of the chicks in group C3, which received cod-liver oil that had been activated 120 minutes with a mercury quartz lamp, were dead in four days, and their blood conditions accordingly could not be recorded. The results of these studies are shown in Figure 5, in which the series on the left half of the chart, reading from the top downward, give the comparative readings of the following blood factors: product of serum calcium times serum phosphorus, total serum calcium, calcium per hundred cubic centimeters of whole blood, calcium of serum of whole blood, diffusible calcium, phosphorus of whole blood, phosphorus of serum, nondiffusible calcium, phosphorus of serum of whole blood, the product of cell phosphorus times cell calcium, phosphorus of the cells, calcium of the cells. On the right half of the chart are shown the following factors: cell volume, percentage of cell phosphorus in the whole blood phosphorus, percentage of cell calcium of whole blood calcium. It will be noted that the weight of the normal controls was 120 gm., while those on the butter with high A and low D vitamin content was only 49. But the two groups with lowest weights were those in the one receiving the cod-liver oil which was high in vitamin A and low in vitamin D, and those receiving the overactivated cod-liver oil, thirty minutes in a mercury quartz lamp. The two highest weights were in the groups receiving the oil which was activated in the sun for five minutes and the ergosterol activated five minutes in the sun. The product of serum calcium and serum phosphorus, which, as I have stated, should be forty in mature adults and from fifty to sixty in the period of active growth of young life, is sixty-one in the normal controls but falls to thirty-four in the group A1, receiving butter

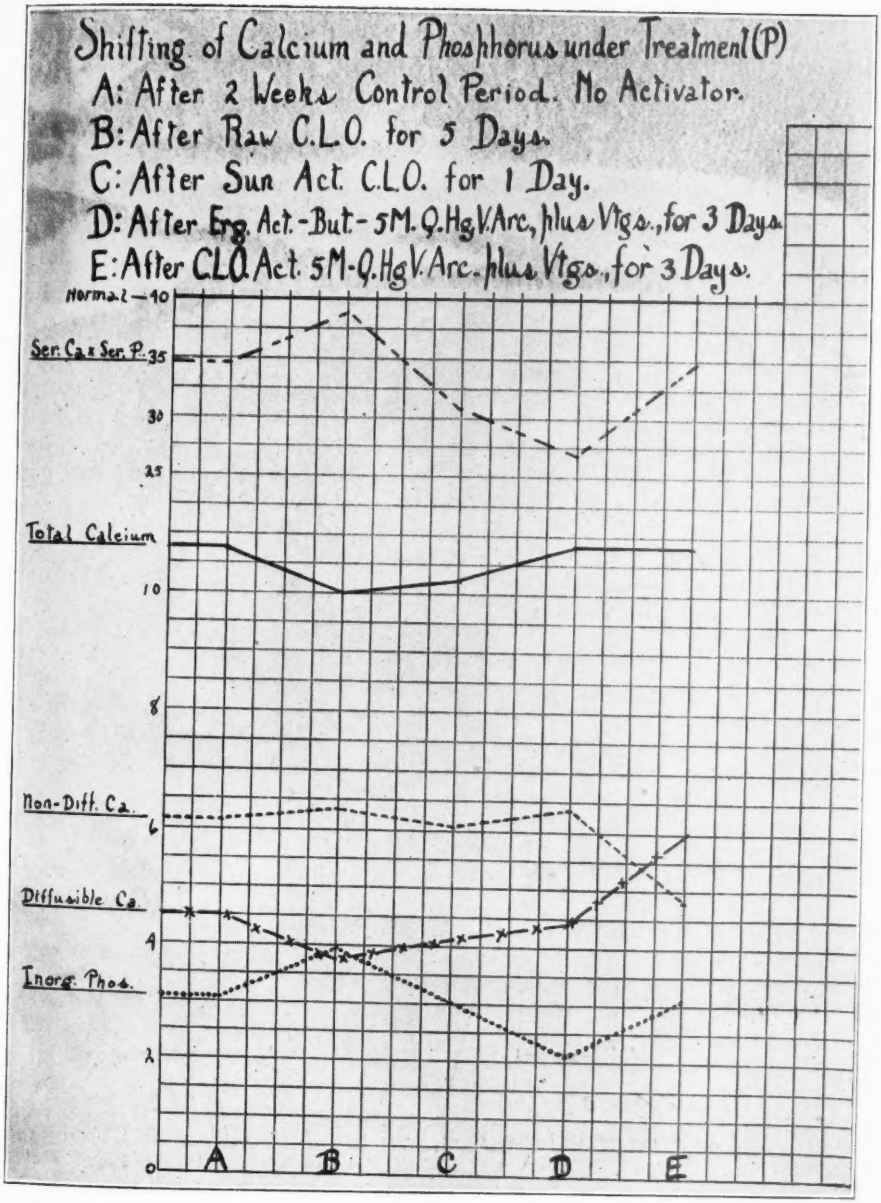


Fig. 7.—Shifting of blood calcium and phosphorus under treatment with various activators (human).

high in A and low in D; increases to forty in group A2, with butter high in A and high in D; reduces a little to 39 in group D1, cod-liver oil high in A and low in D; increases to forty-eight in group B2, cod-liver oil high in A and high in D; is approximately the same in group C1, activated in the sun for five minutes; increases to fifty-one in group C2, cod-liver oil activated thirty minutes with the mercury quartz arc, and to sixty-four in group E1, ergosterol activated in the sunlight for five minutes. Group C3, which received cod-liver oil that had been activated 120 minutes with the mercury quartz arc, having all died, are not reported. By observing the graph for total serum calcium in its relation to the different groups having different treatments, it is readily noted that in A1, with low vitamin D, there is a marked depression with a progressive increase to the group C1 through groups A2, B1, B2, the last receiving the cod-liver oil that was activated in the sun for five minutes, and then decreases through C2 and E1. Similarly, the graph for the next line, calcium per hundred cubic centimeters of whole blood, shown with XX—, and calcium of the serum of 100 c.c. of whole blood, shown with XXX—, can easily be followed. The next graph, diffusible calcium, shown with X—, is of particular importance in that only one group, namely, that receiving the cod-liver oil activated for five minutes, had a marked increase in this factor, which corresponds in general with the increase in the total calcium, but exceeds that quantity which is associated with a decrease in the non-diffusible calcium shown in the next graph and which reaches its lowest point in C1, cod-liver oil activated in the sun for five minutes. This is one of the many illustrations of the advantage of a properly activated, sufficiently good cod-liver oil for the shifting of the diffusibility of calcium toward an increase where the blood chemical findings demonstrate the need for a change in that factor. The inorganic phosphorus of the serum is shown as a dotted line, and it will be noted that there is a marked decrease in A1 with an increase in the other groups. The calcium of the cells, shown as C-X, is an exceedingly important factor and one that has been almost entirely absent in the reports on the study of calcium metabolism problems. This was at 2.2 in the control group, dropped in the butter and ordinary cod-liver oil groups, but increased to 2.3 in the cod-liver oil activated in the sun for five minutes, decreased in the overactivated cod-liver oil, C2, and came up a little in E1. The phosphorus of the cells, shown as C.. O. in the graph, is another important factor. Stresses which make a demand on calcium with a reduction of calcium, either because of a lack of calcium in the food or a lack of the activators necessary for the utilization of that calcium, tend to induce Nature to make a readjustment which frequently involves an increase of phosphorus to compensate for the lower calcium. This seems to be shown in A1, with a low vitamin D.

Just as the product of serum calcium and serum phosphorus constitutes an important basic factor and should equal 40, similarly, the product of cell calcium and cell phosphorus constitutes an important factor. This is shown in the chart as a series of two long dashes and three short ones. This product was 3.7 in the controls, dropped in the ordinary cod-liver oil groups B1 and B2 to 0.5 and increased in the cod-liver oil activated in the sun for five minutes to 4.5; dropped again in the overacti-

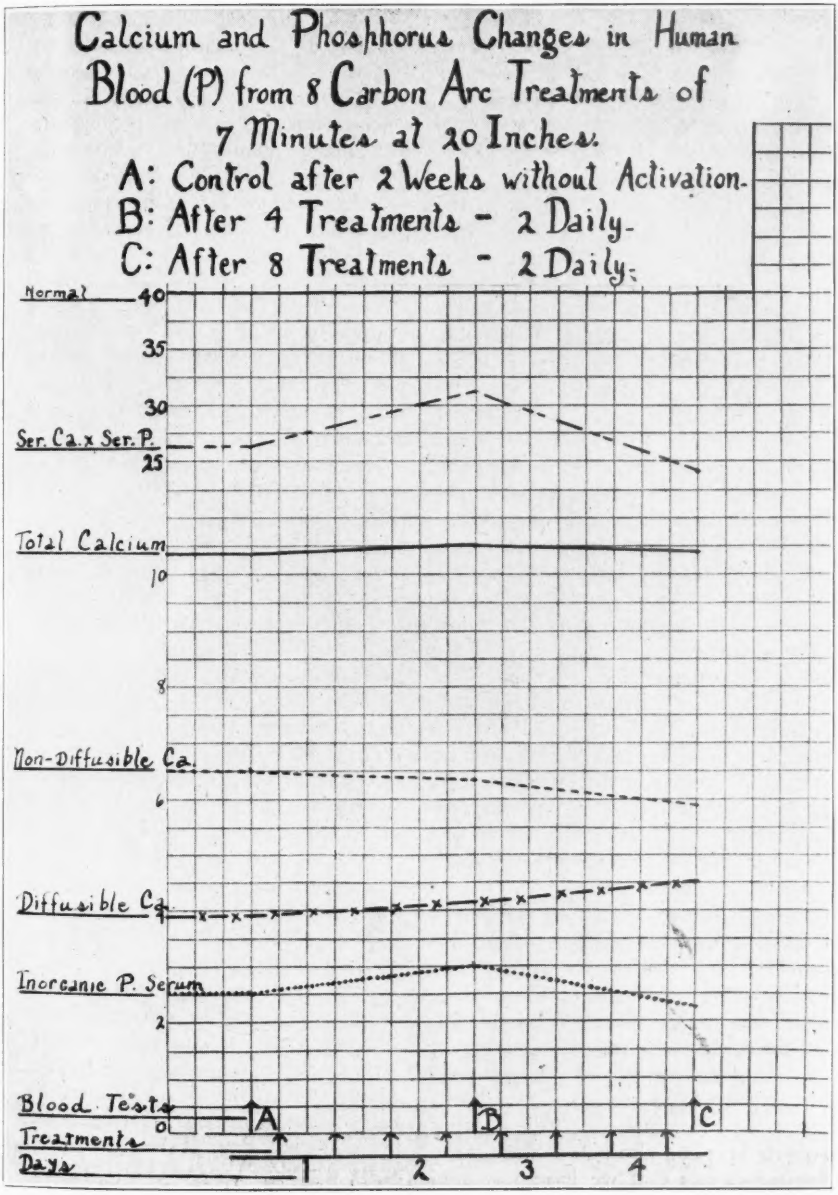


Fig. 8.—Calcium and phosphorus changes in human blood (P) from eight carbon arc treatments of seven minutes at 20 inches. Depression from overtreatment is evident.

vated oil group in C2; and went up a little in E1.

On the right hand half of the chart will be seen the effect on the cell volume, the cell phosphorus percentage of the whole blood phosphorus and the cell calcium percentage of the whole blood calcium. The cell volume of the normal baby chicks is 30 per cent of the total blood volume. In normal adult human beings, it is from 43 to 45 per cent. The effect of the butter which was low in vitamin D and high in vitamin A was to greatly reduce the cell volume to 22 per cent (the ordinates for the right hand group will be found at the extreme right hand side). The relationship of the cell phosphorus to the whole blood phosphorus is graphically shown in the next series, marked C-P-%. This shows an abnormal peak on A1, abnormally low on B2, with a slight increase above normal in C1. The cell calcium percentage of the whole blood calcium indicated as CX%, shows a remarkable decrease in group A1 with a slight increase in A2 and with a very marked decrease in B1 and B2 to an extremely low point, with a marked increase to a little above normal in C1, followed by a marked decrease again in the overactivated cod-liver oil, C2, and some increase, but not to normal, in E1.

Unfortunately, space does not permit discussion here in extended detail regarding why and to what extent and under what conditions cod-liver oil is improved by activation. Note that all of the chickens in group C3 died within a few days, which was the group in which the cod-liver oil had been activated 120 minutes with the mercury quartz arc; and also note that, in many of the factors that we have just been enumerating, there was a marked improvement in the groups receiving the cod-liver oil that had been activated for five minutes in the sun, and much depression in the blood factors of the chickens receiving the cod-liver oil activated thirty minutes with the mercury quartz arc.

Some of those who have presented data which were intended to throw light on the question as to whether oil is improved by activation have apparently drawn conclusions that their evidence demonstrated that it was not desirable.[5] In my judgment, they did not set up the experiment correctly or else did not word it correctly; for what it clearly demonstrated was what I have demonstrated here, that overactivation of cod-liver oil is distinctly harmful. That chickens or rats are not cured of rickets by giving them cod-liver oil activated thirty minutes or two hours is, in my judgment, not an argument against activation, if done properly. The proper amount of activation and the proper kind of cod-liver oil can be beneficial as I have demonstrated in these and many other experiments.

It is difficult to get as much information as I have just detailed regarding a series of experiments on a single chart. In any case, it will take concentration and study to get the facts. In order that I might make these data more easily understood, I have had charts made representing certain of these outstanding factors by the height of the columns which represent each of these factors. This may be seen in Figure 6. The nine groups of chicks are presented again in two phases, one at the left and one at the right of the illustration. Eight distinct factors are emphasized, five at the left, three at the right. These

5. Holmes, A. D., et al.: Am. J. Dis. Child., 34:753 (Nov.) 1927.

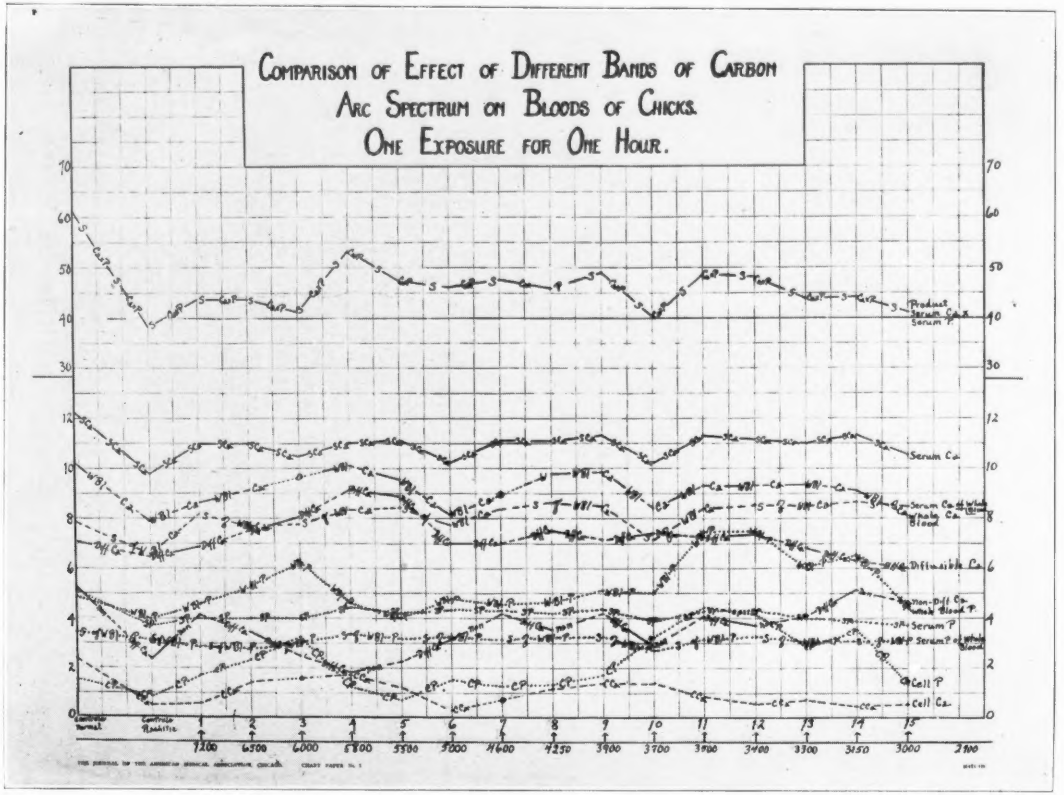


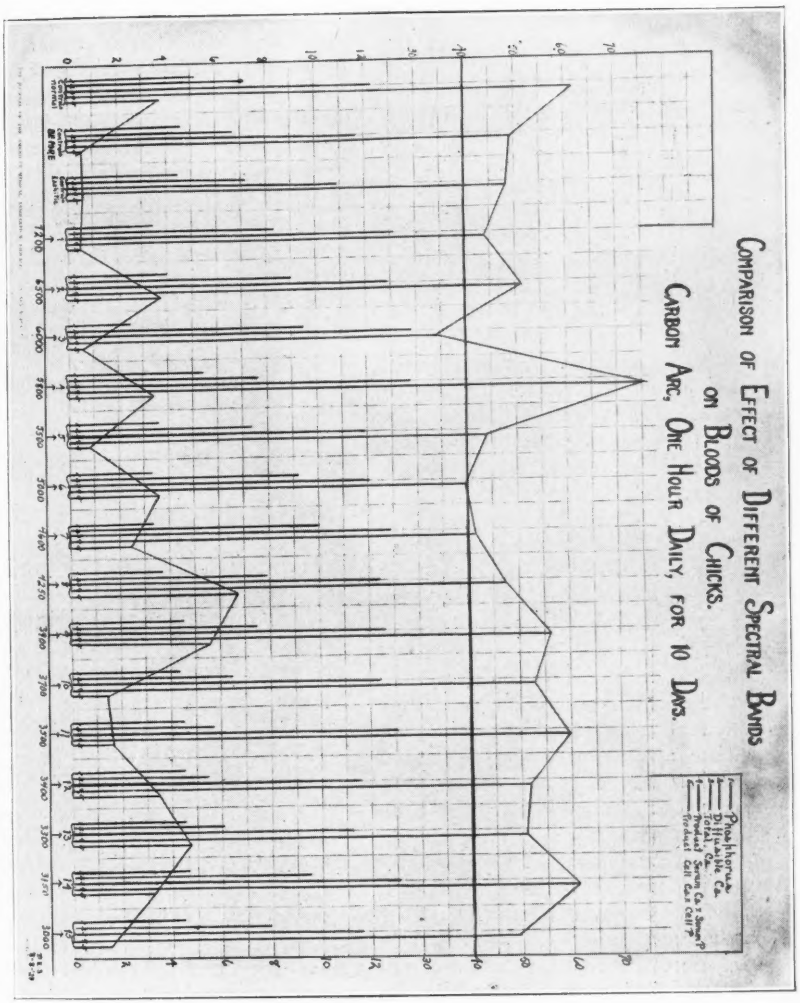
Fig. 9.—Comparison of effect of different bands of carbon arc spectrum on blood of chicks (one exposure for one hour).

are numbered at the base of the perpendicular columns. The columns at the left are solid and the ones at the right are broken. Numbers 1, 2 and 3 (solid columns) represent, respectively, phosphorus, diffusible calcium and total serum calcium; 4 and 5, respectively, the product of serum calcium and serum phosphorus and the product of cell calcium and cell phosphorus. In the group at the right (broken columns), the first column marked 6 represents the cell calcium percentage of whole blood calcium; the second, number 7, represents cell volume, and 8 represents cell phosphorus percentage of whole blood phosphorus. The following are important: The graphic representation of the heights of the fourth solid column in each lot, shows the product of serum calcium and serum phosphorus in relation to the normal at 40; and for only one lot, viz., E1, is it as high as the normal. The relative and actual heights of the columns marked 5, representing the product of cell calcium and cell phosphorus, shows marked variation. Note particularly that these factors are very low in both raw cod-liver oil groups, high where the oil was activated in the sun for five minutes and low where activated thirty minutes. This new observation seems to throw important light on calcium utilization. Another factor that is important is the relative and actual heights of the first of the three broken columns marked 6 in the right hand group, representing the cell calcium percentage of whole blood calcium. This falls very low in the raw cod-liver oil groups and the group receiving overactivated cod-liver oil and is approximately the same in the group receiving cod-liver oil activated five minutes in the sun as in the normal controls. It is also important to keep in mind that all chicks receiving the overactivated cod-liver oil (exposed 120 minutes) died in four days.

My researches on these problems have been and are being carried out on large numbers of individual animals and groups of animals and on a large number of human beings in clinical practice. Many things are being emphasized as data are accumulating, among them the similarity in the effects when treatments are made on the different types, namely, chickens, rabbits, rats and human beings. I have reported many of these items in extended detail in my several papers, chiefly before this Association. In my paper read last October[6] I presented important new evidence which related the reactions of various activators and radiant energy and showed how a shift in the diffusibility of calcium could be produced either by exposing a biologic fluid such as milk or blood serum to radiant energy, or, quite similarly, by shaking the milk with an oil containing activators, such as cod-liver oil which had been exposed to similar radiant energy.

I further showed that different parts of the spectrum have different effects in this regard and also that the exposure of the oil carrying proper activators, to different parts of the spectrum and shaking this with milk or blood serum produced effects that were similar in many respects to that which obtained when the oil or milk was exposed directly to these same spectral bands. Phases of this were also reported

6. Price, W. A.: Calcium Metabolism Studies on the Nature and Rôle of the Activators. Researches on Fundamentals for the Prevention of Dental Disease, J. A. D. A., 16:265 (Feb.) 1929.


Comparison of Effect of Different Spectral Bands
on Bloods of Chicks.
Carbon Arc, One Hour Daily, for 10 Days.
Phosphorus
Diffusible Ca.
Total Ca.
Ratio Ca : Phos.
Product Ca × Phos.
Control
Before
Control
Before
Control
Before

in a paper read before the New Jersey State Society.[7]

Among my experimental groups, I have a number of patients who can add an important contribution by their description of the changes in their conditions, an aid which, of course, cannot be obtained from experimental animals. Several of these patients can tell when I am having difficulty in obtaining the grades of cod-liver oil that I desire for this work. I have also had great help from making determinations on myself and comparing my sensations with the blood chemical findings. Some of these have been most enlightening. A typical illustration will be found in Figure 7, which shows successive studies on my own blood in five different periods. This series is a comparative study of the effect of different kinds of activators on the several blood factors, five of which are presented here. Notwithstanding the great helpfulness of the proper activators for my maintaining an efficient physical condition, I eliminated special activators from my schedule during the period of this experiment. *A* shows the condition of these factors of the blood after a two weeks' control period without activators, at which time the product of the serum calcium and serum phosphorus, which should be 40, was at 34, and the diffusible calcium below the nondiffusible. After taking raw cod-liver oil, two 0.6 gm. 0 size capsules with each meal, for five days, the serum calcium went down, as did also the diffusible calcium, which was already too low. This, a characteristic effect of the administration of raw cod-liver oil, is shown in *B*.

I next took some cod-liver oil that had been activated in the sunshine for five minutes, but for one day only, two capsules with each meal. It will be noted in *C* that, even in this short time, there was a change in the diffusible calcium level, shown in the graph as the row of alternating x's and dashes. The total calcium of the blood also rose, but owing to the depression of the serum phosphorus, the calcium balance, or the product of serum calcium and serum phosphorus, fell. For the next immediate test, I took an ergosterol preparation in 0.002 gm. doses, activated in butter in the mercury quartz arc for five minutes. This is shown in *D*. There was an improvement in the diffusible calcium and total calcium, but not in the serum phosphorus. I then took for three days a cod-liver oil preparation that had been activated for five minutes through a filter consisting of vitaglass. This filter should be noted. It cut off most of the ultraviolet beyond 3100 A. U. This is shown in *E*, and it will readily be seen that there was a rapid rise in the diffusible calcium, so that it took a position a little above the nondiffusible. The inorganic phosphorus rose sharply, with the result that there was a rapid improvement in the calcium balance, or product of serum calcium and inorganic phosphorus.

There has been much misapprehension and misunderstanding regarding the relation and interrelation of certain of the vitamins, particularly vitamin D, and radiant energy. It has been assumed by many that vitamin D can be a substitute for radiant energy or, vice versa, that radiant energy may be a substitute for vitamin D. While several similar effects may be produced by radiant energy of certain types and by vitamin D, it must also be kept in mind that only the radiant

7. Price, W. A.: New Fundamentals for the Prevention of Dental Disease, with Special Consideration of Calcification and Decalcification Processes, Dent. Cosmos, 71 (Feb.) 1929.

energy which is absorbed can produce physical reaction; and in order that it may be absorbed, there must be certain chemicals present that will absorb the radiant energy. Presumably, these are in considerable part related to the cholesterol of the blood and epithelial covering of the body.

failure to help produce the helpful substances, because of the absence in the tissues of the chemicals to be acted on, which are now frequently spoken of as provitamins. Rosenheim and Webster[8] have presented important new data which indicate that ergosterol is the parent substance of vitamin D and prob-

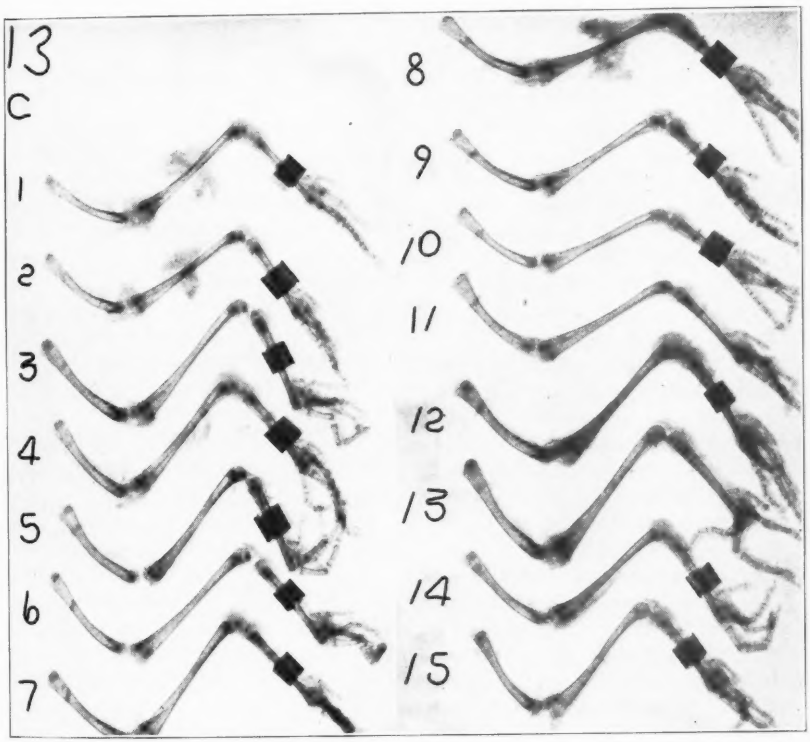


Fig. 11.—Comparison of calcification and growth in legs of chicks placed in different bands of carbon arc spectrum (Experiment 13), after one hour daily for ten days.

It has not been generally recognized that great harm can be done with radiant energy and that serious failure can obtain, the former probably by the producing of toxic substances which are distinctly harmful and the latter by the

ably the provitamin with which we are concerned. They, and Windaus and Hess, have presented evidence that this sub-

8. Rosenheim, O., and Webster, T. A.: Photochemical Production of Vitamin D from Ergosterol, Lancet, 2:622 (Sept. 17) 1927.

stance is developed in the body as a product of cholesterol.

Last October,[6] I presented considerable data illustrating the effect of this chemical on the blood chemical factors of rabbits, when injected in minute quantities intravenously, and related these to the spectrums of the bloods of these rabbits.

In order further to ascertain the effect of radiant energy, when applied to the surface of the body, on the clinical factors and to compare it with the activators when taken internally, and to compare the clinical with the blood chemical changes, I made exposures on my own body with the radiant energy from a double carbon arc, carbons for which were cored with calcium sulphate. Treatments were of seven minutes' duration on my bare body, at 20 inches, distance. Two treatments were taken daily, eight in all. The effect of this is shown graphically in Figure 8. *A* shows the position of these various factors after a control period of two weeks without taking a special activator. Again, it will be seen that the diffusible calcium is lower than the nondiffusible. After two treatments, shown in *B,* it will be seen that the inorganic phosphorus had gone up, as had also the total calcium, a marked rise in the calcium balance resulting. After four more treatments, two daily, blood was taken again, and a condition, the symptoms of which I was feeling distinctly, was found to have occurred in my blood, which was very unfavorable. The inorganic phosphorus dropped sharply. The diffusible calcium increased in proportion to the nondiffusible, the total calcium receded and the calcium dropped considerably below its low level at the beginning of the experiment. I had considerably injured myself physically by overtreatment, yet doubtless not more so than the hosts of people being injured by their unintelligent application of artificial sources of radiant energy to their own and other persons' bodies. That I had seriously overdosed myself with radiant energy was clearly proved in another way, for I developed the most severe cold that I have had in two years.

I have seen a number of individuals who have brought on conditions more alarming than mine by overtreatment with their home installed mercury quartz or carbon arc units. I have also seen many who present evidence of serious injury from treatment in laboratories and parlors provided for the wholesale applications of this would-be cureall. The error is not to be laid to the use but to the abuse of a force that is competent, when properly applied, to do great good. This and many other experiments have indicated the great need for knowledge regarding the comparative influence of the different parts of the spectrum of radiant energy that may be produced by the sun or an artificial source of radiant energy.

As an approach to this, I have constructed a large spectograph, in which I can expose thirty chicks or thirty rats at a time, in two decks, each of the fifteen pairs receiving a different part of the spectrum. In Figure 9 is a chart illustrating the results of one of these studies as revealed in the analysis of several blood factors as indicated.

The range of the spectrum used in this experiment is from 7,200 to 2,900 Angstrom units. The centers of the groups of bands falling on each successive pair of chicks, one above the other, are shown on the chart with arrows with the approximate length of the central band in the group. The carbons used were therapeutic C developed by the National

Carbon Company, and the period of exposure was one hour. The amount of energy used was relatively small, since only a narrow slit, approximately 2 mm. in width could be used at a distance of about 5 cm. from the arc. The total distance from the chicks to the arc through the three prisms and two 5-inch fused quartz lenses, all built especially for this spectograph, was about 9 feet; the range was from the infrared through the visible spectrum and into the ultraviolet as far as is transmitted by sunlight. In other experiments, I have adjusted the instrument to go much farther into the infrared and ultraviolet regions. This experiment has been made many times with rats and chickens, and always with the same general result, namely, that there is a distinct difference in the blood changes produced by different parts of the spectrum, and that, in approximately the same positions, changes are produced when either blood serum or milk are placed in quartz tubes and exposed similarly to different parts of the spectrum and then analyzed for shifts in the diffusibility of the calcium. In general, the results are similar to the effect produced by exposing cod-liver oil in quartz tubes to the energy from different parts of the spectrum and shaking milk or blood with the oil from these different tubes and then separating and noting the shift for diffusibility of the calcium of the milk which has received an energy factor from the cod-liver oil, which, in turn, received an energy factor from the radiant energy. Two types of controls were used: chickens having a normal exposure and normal food, shown in the first group, and rachitic controls having the deficiency diet and required to eat in very subdued ruby light. The upper graph shows again the product of serum calcium and serum phosphorus and reveals a marked depression between the normal controls and the rachitic controls. All of the other chicks used in this test had presumably the same blood condition as the rachitic controls before the exposure, and our study has demonstrated many times that healthy chicks having the same general parentage and incubation and brooding history, when hatched, have very constantly similar blood conditions, and therefore the second column shown as rachitic controls can be considered as typical of the individuals of the like experiments. It will be noted that there was a distinct increase in serum phosphorus and serum calcium in such position as to make the curve rise sharply in cage 4, another rise at 9, a depression at 10 and a rise at 11. It can be seen at a glance that many factors have changed radically. The calcium and phosphorus of the cells both changed to a marked degree. This experiment was repeated in different ways. Each group of chicks was exposed daily except Sundays for seven days. Numbers 2 and 10 died before the period of experiment was terminated, which made a break in the series with regard to blood chemical studies. It was found that, in general, the same condition obtained, but in a more marked degree. Still another series was run (Figure 10) in which the chickens were exposed one hour daily for ten consecutive days except for one day. Four series of fifteen were run, two at a time, one above the others, and of these two were taken and their blood pooled to get an average for this chemical test. A most remarkable result was obtained. The condition already presented in Figure 9 with the one hour exposure was found emphasized in the seven-day treatment and found to be very greatly emphasized in the ten-day treatment, as will be observed by noting the height of the

columns in Figure 10, representing these factors. The control chickens not exposed with mild beginning rickets at the starting of the experiment became more and more rachitic, and the entire lot of sixty controls were dead at the end of the experiment, while the light from all the different bands had been competent to keep the chicks alive; which throws light on the question as to whether or not light is necessary and what kind of light is necessary or competent for the continuance of life for this period. Note that again, in cage 4, the product of serum calcium and serum phosphorus shown in the vertical columns No. 4 has gone far above the normal controls, and the chicks in 9, 11 and 14 are nearly equal to the controls and only the group in cages 3 and 6 have gone down to or below the base line 40. Of equal, if not greater, importance is the change in the product of cell calcium and cell phosphorus shown in column 5. It has dropped very low in the rachitic controls, is equal to normal in cage 4, and is far above normal in cages 8, 9, 13 and 14. We have similarly a very marked change in the phosphorus of the serum and in the diffusible calcium shown in columns 1 and 2 of each group. These studies emphasize greatly certain factors in the blood chemistry which are profoundly influenced by radiant energy. Many other groups of determinations have been made to throw light on this experiment but space does not permit me to include them here.

These studies that we have just been reviewing have to do with the changes in the chemical constituents of the blood of chicks receiving different diets and others receiving different types of treatment.

I began the discussion of these studies by presenting a case of ununited fracture and showed its change in twelve weeks' time, stressing the importance of the relationship of the changes in the structure of the bone to the changes in the blood chemical constituents. I shall now present further evidence, emphasizing the correctness of that interpretation. If, as I have assumed, blood chemical factors determine largely whether calcium will go into or out of bone, it would be logical to expect that we might see some differences in the changes in bone development in the chicks irradiated by different parts of the spectrum.

This information is presented in Figure 11, a roentgenogram of one leg of a chick from each of the different groups. As only one leg was banded, there is no significance in the fact that all the legs presented do not have bands. Note particularly the difference in the length of the tibiae. It will readily be seen that there is a very marked difference, and, further, that corresponding with the zones of increased product of serum calcium and serum phosphorus and of high product of cell calcium and cell phosphorus, there is marked increase in growth of bone.

Several other types of studies of these several series have been made, and many other series which space does not permit me to present. These include the making of spectrograms of the blood specimens, the chemical analysis of the shafts of bones for the relative and actual amount of the various inorganic constituents and the staining of bone sections for study and comparison of the zones of provisional calcification.

Another important phase of this problem has been intensively studied, but space does not permit of its inclusion. This has to do with the nature and source of the vitamins and provitamins, which are necessary for adequate calcium

metabolism. The latter includes an elaborated extension of the studies begun some years ago, and reported before the Seventh International Dental Congress at Philadelphia,[9] on milk and milk products and factors which might influence the vitamins in milk and other food products.

The matter of the selection and preparation of the activators is of profound importance, and researches have reached the point where it is now possible to enhance the available sources greatly. I am putting all this in text form, which will probably be available in a few months. This text will also include detailed methods for the various determinations and analyses. I shall also present in this volume additional cases of ununited fracture.

Notwithstanding the fact that I have already exceeded the space which should be used for this presentation, it seems imperative to make some direct application of helpfulness for the members of this section, an application which will be equally helpful to all in general dental practice.

The maintenance of normal defense or immunity requires calcium and phosphorus, in adequate amounts, available in the blood stream quite as much as for the repair of bone, and our entire scheme of preventive dentistry will in my judgment be built upon this foundation. We are therefore going to come to the preparation of the patients for operation, when operations are necessary, by giving them this type of reenforcement during the time they are making this repair. Further, it is not too much to expect that we shall come to a type of dental practice which will prevent quite as effectively dental caries and pyorrhea and other decalcification processes, and these are quite dissimilar, as we may aid, as I have demonstrated is now possible, in the process of repair of ununited fractures.

I interpret these data as follows: Since a minimal amount of calcium and phosphorus is essential for daily needs in health and a greater amount is required in disease, if the required quantities cannot be supplied from the food, whether for lack of calcium and phosphorus in the food or from lack of activators to make them available, a draft will be made on the storage in the skeleton. This produces a state of stress which disturbs function until that stress is removed by the replacement in the bones of the borrowed calcium and phosphorus.

This condition constitutes an important factor in the development of the so-called degenerative diseases both by disturbing organ function and by lessening the body's capacity to fight infection; hence, there is a reduction in immunity.

With lowered resistance to infection, local quarantines break down, such as those about infected pulpless teeth, which now become a liability. Such an individual is in negative calcium balance while using calcium faster than he is assimilating it. This condition constitutes a very common and important factor in the expressions of age, whether in early, middle or old age. Such individuals, for the time being, may be said to be dying, or, as someone has expressed it, people do not die from degenerative diseases, rather they get the degenerative diseases because they are dying. In this state, focal infections, dental or otherwise, may provide a strain of infection with localizing qualities which will, by this tissue affinity, rapidly or slowly break down some organ, and, at the same time, injure the defensive mechanism by the systemic calcium stress. Hence, focal infections

9. Footnote 2, second reference.

should be eliminated before the capacity for maintaining immunity is lost. An infected tooth would require very great strategic value to offset this capacity to do harm. Under nearly all circumstances, therefore, infected pulpless teeth should be removed before the systemic state of lowered resistance develops.

8926 Euclid Avenue.

DISCUSSION

A. B. Vastine, Danville, Pa.: Does the same thing that applies to butter and cod-liver oil apply to the food of chickens, as to the time of year, exposure of food, and so forth, and to the eggs that are produced?

Dr. Price: It will make a great difference, but this must be kept in mind. Sunlight or any other source of light cannot act as an activator on the blood of an individual who does not carry the proper provitamins to be activated.

Dr. Vastine: You misunderstood my question. Do you know whether the time of year that eggs are produced has the same relation to the time of year that butter is produced?

Dr. Price: Yes, that is true, and there are several factors in connection with it. The ratio of pullets to cocks that are born in February and March is different from the ratio of pullets to cocks that are born in June and July. It affects a lot of factors that go with this problem of the fertilization and maturation of the ovum and the development of the chick.

W. I. Jones, Columbus, Ohio: You showed some pictures in which you said the cod-liver oil is rubbed on the skin of the chickens. Aren't we taught in most physiologies that the skin does not absorb? Did you feed these chickens cod-liver oil at the same time?

Dr. Price: No, these were not fed cod-liver oil; it was applied topically.

A. C. Wherry, Salt Lake City, Utah: In your check-up on butter, did you find any relationship to altitudes?

Dr. Price: In general, the farther north we go, the more rain and more good pasture we find, and, in general, the better the average of the vitamins D and A. In those states where they ship in the food for the cows and do not have much native grass, vitamin D has been low, and we have here one of the important contributing factors to the cases of enamel hyperplasia that are developing in many of the western and southern states. Some of the best tests we obtained were on butter from Manitoba. Some western butter has been among the poorest we have tested. We were getting two kinds of butter from some western states. I learned that the cows in some states were given a diet which seldom contained grasses, but contained barley that was shipped in from the north and grains that were shipped in, and only occasionally did the cows have an opportunity to graze or browse among leaves. The colds that many people have, I think, are largely due to the low vitamin content in the foods. Milk and butter are really the chief source of vitamins A and D. Activation of a cod-liver oil that is low in suitable provitamins will not improve it. It will do some harm probably, and I would advise against doing it. I do not know why some of the cows under the same condition of diet and the sunshine have high vitamin D content and others do not. I found this an interesting thing. One cow had the history of having a very poorly nourished calf; her half sister also had a very poorly nourished calf. The milk of these cows was low in vitamins. There seems to be evidence that this is partly an inherent personal quality. It does not seem to be entirely due to species or grade; that is, we cannot say that Holsteins or Ayrshires or any other particular type will all furnish milk that is high in A and D vitamins. I do not know where you can get cod-liver oil that is always high in vitamin D, because the manufacturers are not yet, as far as I know, putting figures for vitamin D on the bottles except to say that not less than a certain minimum is contained. To state that the contents contains an ample quantity may be enough on the basis of the chicken or rat experiments, although as you see by the evidence here presented it is not nearly so good as that that is high. I think that ultimately the cod-liver oil manufacturers and supply depots will furnish cod-liver oils with figures for both A and D vitamins. For the present, I know of no better way than to take it myself or to make one or all chemical analyses a biologic test on animals or a spectrographic test. Emulsions are generally low in vitamin D.

A NEW TECHNIC FOR THE MECHANICAL CORRECTION OF CLEFTS OF THE MAXILLAE*

By CARLETON FOX, D.D.S., Detroit, Mich.

IT has been my ambition since my early contact with clefts of the maxillae to minimize the surgical hazards which are encountered in the approximation of cases of this type. The prolonged anesthesia, shock and dietary upsets, as well as the postoperative complications which are encountered in this particular type of work, were the stimuli for the development of this technic.

Dr. Brophy, in 1884, used a steel clamp for the mechanical approximation of clefts of the maxillae. Drs. Hammond and Roberts used an appliance which was a modification of the Brophy clamp, a few years later. Other men have used mechanical means, but the literature does not tell us who the men were nor when the appliances were used.

Any of the accepted methods for the approximation of clefts of the maxillae are used, silver wires being introduced through the bones and supported by lead plate on the buccal mucosa. The bony structures of the cleft are manipulated until the borders are in approximation, and the wires are then tightened and the edges scarified. The cleft is then closed and the edges sutured, after which the wires are tightened, holding the maxillae in contact. To perform this type of operation, the greater part of an hour or more is required. With this method, shock, dietary upsets and pneumonia are not infrequently met with, and too many times have proved fatal.

Closure of a cleft employing any one of these methods results in a marked edema of the entire facial structure, no matter how narrow the cleft may be. Fractures of the maxillae have occurred from such manipulation, without taking into consideration the destruction and displacement of developing tooth buds.

Pressure will cause bone development. The orthodontist uses this principle in his correction of malocclusion, knowing, from the work of Oppenheim on tissue changes, that, during tooth movement, gentle, continuous pressure will produce a physiologic development of bone; while, if the initial pressure is great, the bone is compressed and trauma results, leading to bone atrophy.

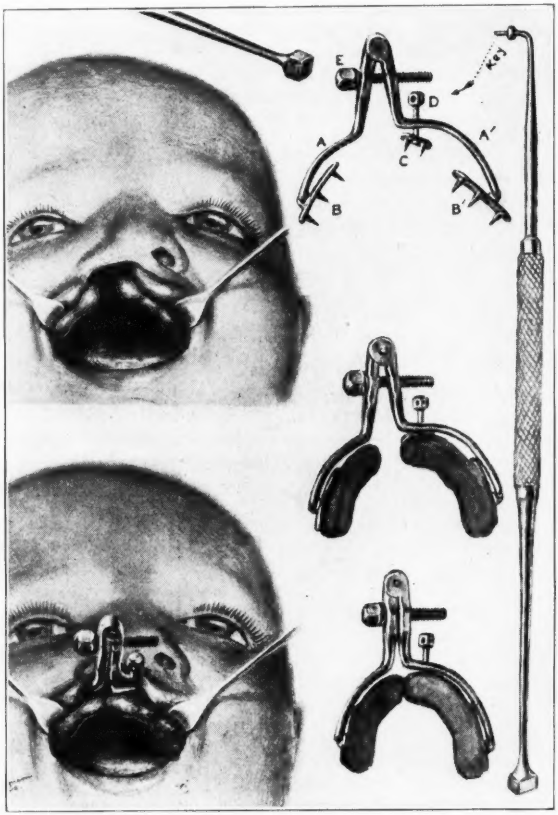
It was the application of gentle pressure that Brophy, Roberts and Hammond used in their clamps, and the same principle is employed in the clamp which is shown herewith.

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 22, 1928.

DISCUSSION

A. L. Frew, Dallas, Texas: Dr. Fox has no doubt given us something very valuable in the correction of cleft palate. I have always followed the Brophy method of wiring the maxilla into place and I have always found it very satisfactory, but I can see great possibilities in this new method, and I shall be one of the first to follow Dr. Fox's method. Speaking of the old method of wiring: It is true that it

does take a little longer, possibly, to adjust it than with this method. In my experience, I have had very little shock. Most of these cases are handled when the child is very young, sometimes during the first five months of age. I never have yet had a fatality from this particular operation. The principle involved in the wiring system, as in this, is to place the wires high, up through the maxilla, not through the alveolar process. Unless the wiring in these particular cases is placed high, we invite failure. It has been my observation that when the wires are placed sufficiently high in the maxilla, it is above the tooth structure, and I believe there has been very little distortion of the teeth due to placing wires through the maxilla in this particular operation. I recall seeing an illustration in one of the recent textbooks of a model showing teeth very much distorted, and the reason was given that the wiring in closing the hard palate had distorted the follicles. Last year, I had a patient who had never been operated on, a girl about 12 years old. The teeth were very badly distorted. In the textbook an operation had not been per-



Schematic drawing illustrating clamp. Since this drawing was made, at the suggestion of Samuel J. Lewis, a spiral spring has been used between the head of screw *E* and arm *A*, which produces continuous gentle pressure.

formed, so possibly the wires in the case caused the irregular position of the teeth. We have a great many cases of older children. I have had several patients, from 5 to 15 years of age, with extremely wide clefts, and we found it possible to close the cleft only by an anterior fracture; that is, a fracture of the anterior part of the maxilla, going back of the cuspid, chiseling through above the apex of the cuspid over to the nose and making a green stick fracture, later on closing the lip, and the posterior part of the soft palate. In the older patients, it is necessary to fracture the bone, but if we get these cases at an earlier age, they can be manipulated and forced into a normal position without fracture. Some men advocate closing of the lip over these clefts without first closing the cleft. That probably can be done in a few cases. There are many cases in which the cleft is so wide that even the manipulating of the bone just previous to the closing of the lip is not very satisfactory, because it gives a wide gap to build the lip over and the result later is a thin, drawn lip. I have had the privilege of examining cases that have been taken care of or handled in that way, and I do not feel that it is so good a method, to say the least. There are a few cases in which it may work out all right, but I believe that we have to build a foundation before we can build a lip. Not only that, but the closure or bringing of the cleft over to the median line also straightens up the septum and nose, because, in all of these cases, there is a deflection of the septum to the long side; and by breaking the bone over, and bringing it into place, we at that time straighten the nose and give a much better profile and front view.

Carl D. Lucas, Los Angeles, Calif.: The appliance that Dr. Fox is presenting to us today is an innovation, and the results to be obtained in the application of force which is a combination of direct force and constant force by the use of a coil spring in the set screw of the appliance remain to be seen. Many men who are doing palate work have been associated with the man considered by all to be the father of cleft palate and hare lip surgery, Truman W. Brophy. Those who have worked with him remember that he stressed, on innumerable occasions, the vast importance of placing the wires high enough that the tension applied will bring the hard palate into an arch form instead of an exceedingly conical form. Dr. Brophy stressed the importance of placing the tension wires in position above the alveolar process to accomplish this result. The lead plates do not rest upon the surface of the mucosa of the alveolar ridges, but incisions in the mucosa are made between the cheek and above the upper border of the alveolar ridge so the lead plates may be placed higher than they could be placed, were the mucous membrane and periosteum left intact. At first blush, it seems that the appliance which Dr. Fox has presented is almost impossible of adaptation high enough to bring the alveolar process or the alveolar ridges into the proper arch form, thereby bringing the cleft of the palate in enough apposition to make a subsequent plastic operation which will leave the soft tissues in such a position that they may unite, on closure, without being on tension, inflexibility of the soft palate resulting thereby. I can see the advantage of this clamp if it can be placed high enough to bring the cleft of the palate into close enough apposition for future plastic repair without tension, but if the clamp cannot be placed high enough, it seems to me that it will direct the alveolar ridges into a V-shaped form, which is not desirable, because we must place the maxilla in proper position in order that the cleft of the soft palate may be subsequently repaired without tension. This appliance is an innovation, to be tried out and its efficiency proved or disproved in this type of surgery. It appeals to me as a very ingenious appliance. I can see that it will conserve a great amount of time, thereby minimizing shock to the patient, and that it may be adjusted under very light anesthesia, which will also minimize the shock of operative procedure.

T. A. Hardgrove, Fond du Lac, Wis.: It seems to me that this appliance marks a step in the progress of oral surgery. I cannot see any reason why the force that can be applied with this instrument cannot be just as practical as that from a wire. In fact, I think that Dr. Fox has absolute control of the force that he applies. That is the thing that will make the method practical. I cannot see why Dr. Brophy ever started to use this method of force and then discarded it in favor of the operation that he employed. Those of us who have been taught by him know that he often made the statement that, in many of those cases, he could almost bring those clefts together with his fingers. That being true, it would seem to me that this appliance would

supply what was lacking to complete the case. As to placing the pressure high enough above the alveolar border, it can be as well done with this as it could with the wires, even though we had to incise the tissues to place it high enough.

If we can avoid anesthetic trauma and shock to the patient and prevent fatalities in those cases where the thymus is at fault, a step will be made in the progress of surgery that is almost equal to some of the great work done by the masters before this time.

Dr. Fox (closing): I think Dr. Lucas hit the keynote of the presentation. The method is in its formative stage and what we wish to do is prove its worth. I have tried to keep away from case histories, and do not believe that anyone should boast about the particular method or thing they have worked out until it has been proved efficient. I feel that fifty or seventy-five cases would afford sufficient proof, but I have not handled that many as yet. It will probably take considerable time to accumulate adequate data, but those cases which we have handled have proved to be entirely successful. As far as the height of the so-called buccal pad is concerned, it is quite easy to put them up above the alveoli, as our "Old Chief" did in putting the incisions on the upper buccal mucosa, using his method. If the tissues of the mouth are not adaptable to the lead plate and silver wire technic and incisions have had to be made in the buccal mucosa for their reception, the same incisions will accommodate the buccal pads of the clamp. I was a little reluctant in making this presentation, feeling that I did not have enough to offer. On second thought, I brought it merely for your consideration.

A METHOD OF KEEPING RECORDS*

By O. W. BRANDHORST, D.D.S., St. Louis, Mo.

THE keeping of records is probably one of the most neglected essentials of our daily practice. Few of us have had a business training, and most of us are therefore not inclined to view record keeping as very important. Besides, most of us find the strain of a day's work such that we are content to reduce record keeping to a minimum. The result of this is that we frown on the thought of an extensive system, thinking it entirely beyond us, and we forego the attempt even to try to find one that will fully meet the requirements.

Within the last few years, the Federal Government has seen fit to demand that records be kept so that accurate income returns may be made. This has to do only with receipts and disbursements, but it has forced the issue, and let us hope that it will stimulate us to go farther and keep other records, too.

As orthodontists, we are perhaps more inclined to delve into a patient's history than is the general practitioner, owing to the nature of our work, and we are therefore more apt to have some kind of record system.

To cover the entire subject of record keeping is out of the question, and our efforts therefore will be confined to only a small portion of what might be considered an orthodontist's records.

For convenience, we can divide them into five groups: (a) plaster records, (b) photographic records, (c) roentgenographic records, (d) graphic records, (e) written records. It is the last of these

*Read before the Section on Orthodontia and Periodontia at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 22, 1928.

that we wish to discuss. However, one is rather closely associated with the other, and, of necessity, we may have to refer to some of the others from time to time.

Generally, records today are kept in one of two forms, depending on the individual's preference. We refer to these forms as bound volumes, or loose-leaf systems. The former is rapidly being replaced by the latter, and the debits and credits, histories and financial records and statements.

THE APPOINTMENT BOOK

One of the first records that we are called on to keep is the appointment, and every one of us does this in one form or another.

After considering various methods, we finally came back to the bound book form. The one that we use is the

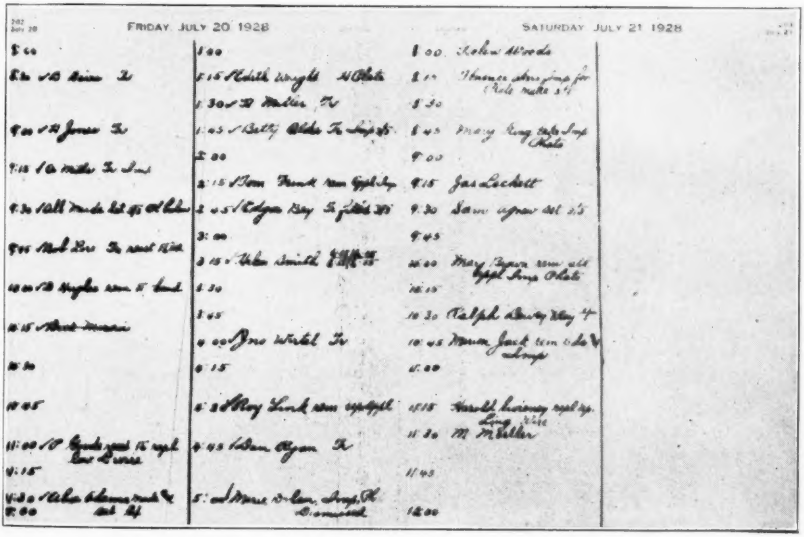


Fig. 1.—Appointment book showing entries made. On the left, the day's completed work is posted; on right, the work planned for the day.

loose-leaf or card system, together with a method of filing, is the order of the day.

In the method to be presented, we have combined the bound ledger system with a loose-leaf and filing system, into what has proved to be a simple, but efficient and accurate, system.

The recording will include appointments, memoranda, services rendered, Standard Diary No. 362, with pages 8 by 10 inches. This book has one page allotted to each day of the year, and the date is plainly printed at the top of the page. For convenience, each page is divided into halves by drawing a line down the center from top to bottom. The left half is then arranged for the morning hours, and the right half for the afternoon hours.

Sufficient space is allotted for each hour, and the number duly written in. In this book, then, beside the proper time, is listed the patient's appointment, and sufficient space is available to write in the services rendered, or such other information as one might wish to record.

Certain signs or symbols are used to denote specific conditions, all of which can be made to suit one's own convenience. For instance, when the patient comes in for the appointment, a check (√) is placed in front of the name. When the patient has been cared for, the services, etc., are recorded, just back of the name. If something special is planned for the next appointment, it is written down behind the name when the next appointment is recorded.

If a patient fails to keep the appointment, a line is drawn through the name and the check mark (√) placed before it. This indicates a broken appointment. If the patient telephones and changes an appointment, a line is drawn through the name, but no check mark is placed before it. (Fig. 1.)

The appointment book therefore serves to record not only the appointment, but also the services rendered and planned. It is, in reality, our day-book.

From this day-book, of course, we must transfer the "notes" to the permanent record card for each individual patient.

The 5 by 8 card is fast becoming the universal card in the business world, and we have adopted it as our standard. We use these cards for the examination

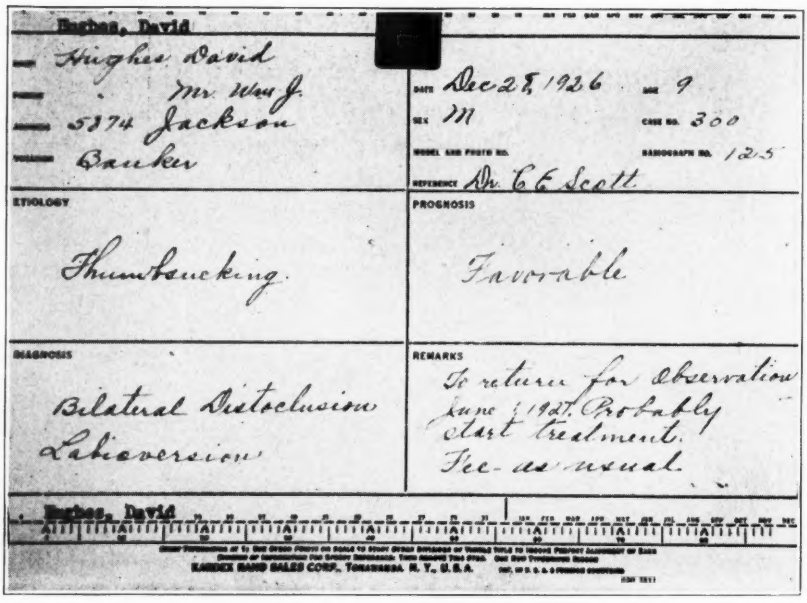


Fig. 2.—Examination card (front).

cards, history charts, ledger and index cards. They are especially arranged for what is known as the Kardex File.

Before launching into the details of this system, which has taken away most of the drudgery of record keeping, we will describe first each of these cards mentioned above, and then show their combination in the Kardex file.

prognosis, diagnosis and remarks. (Fig. 2.)

This card is used when the patient comes in for the first time, and is referred to later as necessity requires. A record is made of the condition found, together with the possible etiologic factors. Later observations are checked against those recorded, and this is valu-

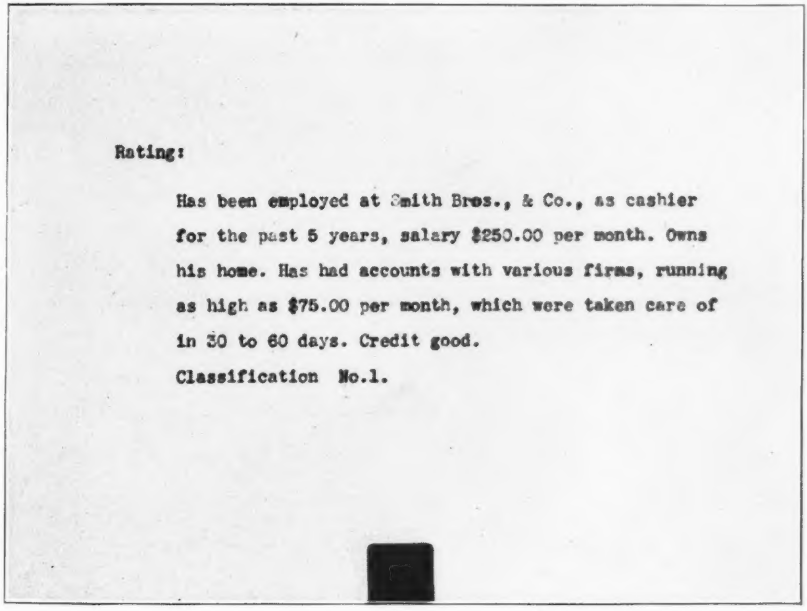

Rating:
Has been employed at Smith Bros., & Co., as cashier
for the past 5 years, salary $250.00 per month. Owns
his home. Has had accounts with various firms, running
as high as $75.00 per month, which were taken care of
in 30 to 60 days. Credit good.
Classification No.1.

Fig. 3.—Examination card showing commercial rating and classification.

THE EXAMINATION CARD

The examination card is a light weight card, properly notched to fit into the pocket of the file. On its face, it has spaces outlined for the name of the patient, name of parent or guardian, address, vocation, age, sex, date, case number, model number, photograph and roentgenogram number and reference. Larger spaces are outlined for etiology,

able in determining the prognosis of the condition.

Under the heading of "remarks," we write in the advice given, the plan of treatment outlined, and any reference to finances. This card, then, as will be seen, is filed away, but is always readily accessible for reference.

On the extreme upper and lower margin, we find a series of numbers from

1 to 31 (denoting the days of the month), and the names of the months. Both of these serve a definite purpose in indicating appointments or special services, as will be seen later.

The reverse side of the card, which is blank, is used to record the responsibility of the parent, in accordance with the information obtained from the retail credit bureau. Our purpose here is to establish the honesty of the person, rather than to find out about his wealth. On this basis, we classify the patient as follows: 1. Those who are honest and can pay. 2. Those who are honest but hard pressed. 3. Those who can pay but will not. (Fig. 3.)

This card has an extra one-half-inch wide stub at the bottom. Its purpose is to enable one to hold the card easily in the typewriter in typing the name on the lower margin. Typing the name at the upper and lower margins makes it plainly visible from either side of the pocket, and it can therefore be placed in either the upper or the lower half.

THE LEDGER CARD

The ledger card is the card used for tabulating and recording the services rendered, the charges, credits and balance due. It is also 5 by 8 inches, horizontally ruled, with special vertically ruled columns for date, charges, credits and balance.

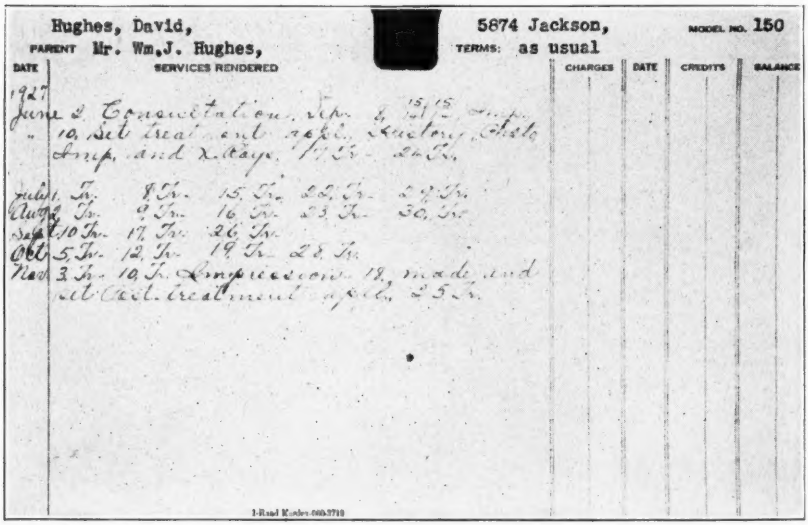

Hughes, David,
PARENT Mr. Wm.J. Hughes,
5874 Jackson,
TERMS: as usual
MODEL NO. 150
DATE
SERVICES RENDERED
CHARGES
DATE
CREDITS
BALANCE
1927
June 2 Consultation. Tr. 8 Tr. 15 Tr.
10, Set treatment note. Lantern, Photo
Amp. and X-Rays. 17 Tr. 24 Tr.
July 1 Tr. 8 Tr. 15 Tr. 22 Tr. 29 Tr.
Aug 2 Tr. 9 Tr. 16 Tr. 23 Tr. 30 Tr.
Sept 10 Tr. 17 Tr. 26 Tr.
Oct 5 Tr. 12 Tr. 19 Tr. 28 Tr.
Nov 3 Tr. 10 Tr. Impression 19, made and
set. Cast. treatment 24th. 25 Tr.

Fig. 4.—Ledger card, showing entries.

In the upper left corner is space for the patient's and the parent's name and address. In the upper right is a place for the model number, and the terms agreed on, if any.

Both sides of the card are alike, so that they can be reversed, when one side is filled.

The services rendered, as recorded in the appointment book, are entered on

PARENT Hughes, Wm. J. ADDRESS

TELEPHONE NO.	MON	TUES	WED	THUR	FRI	SAT	ANCHOR TEETH SIZES
Cab 1234							6:15 6:15 / 6:14 6:14
Hughes, David							MODEL NO. 150

NAME Hughes, David PARENT Mr. Wm. J.Hughes,

ADDRESS 5874 Jackson, VOCATION Banker DATE June 10,1927

ANCESTRY English REFERENCE Dr. C.E.Scott

AGE 9 SEX M CASE NO. 300 RADIOGRAPH NO. 125 MODEL AND PHOTOGRAPH NO. 150

DIAGNOSIS: Bilateral Distoclusion Labioversion.

PROGNOSIS: Favorable

PLAN OF TREATMENT: Usual

ESTIMATED TIME AND COST: about 3 yrs Charges, Usual

HISTORY		ETIOLOGY
HAS THE FATHER NORMAL TEETH?	yes	PREMATURE LOSS OF TEETH.
HAS THE MOTHER NORMAL TEETH?	no	PROLONGED RETENTION OF TEETH.
WERE THE FATHER'S TEETH TREATED?	no	CARIES. DISUSE. FAULTY DIET.
WERE THE MOTHER'S TEETH TREATED?	no	PULPITIS. PERICEMENTITIS. OSTEITIS.
HAVE YOU TAKEN TREATMENT?	no	NASAL OBSTRUCTION.
FACIAL FORM OF FATHER: NORMAL. ABNORMAL?		HABITS Thumbsucking
FACIAL FORM OF MOTHER: NORMAL. ABNORMAL?		
HAVE ANY RELATIVES ABNORMAL TEETH?	no	TRAUMATISM.
HAVE YOU HAD ANY SERIOUS ILLNESS?	Whc. CP,Y	NUTRITIONAL DISEASES.
Duluth Scarlet Measles		INFECTIOUS DISEASES.
RECURRENT ATTACKS OF COLDS?	no	HEART DISEASES.
ANY OPERATION ON NOSE OR THROAT?	Tng & rem	BLOOD DISEASES.
BRONCHITIS? ✓ RASHES? ECZEMA		NERVOUS DISEASES.
ARTIFICIAL FEEDING DURING INFANCY?	yes	CONGENITAL ANOMALIES.
WERE PACIFIERS USED?	no	TUMORS.
HOW OLD WHEN BEGINNING TO WALK?	1 yr	MACROGLOSSIA. MICROGLOSSIA. ANKYLOGLOSSIA.
HOW OLD WHEN TEMPORARY TEETH APPEARED?	6 mo	HEREDITY.
HOW OLD WHEN PERMANENT TEETH APPEARED?	6 yrs	UNKNOWN
REMARKS:		REMARKS:

Fig. 5.—Front page of the history chart before folding.

this card, together with the date. Payments received are also entered here, together with the date. The balance due is always carried to the column at the extreme right, and the account is therefore always ready for inspection. (Fig. 4.)

Broken appointments are entered in red; which, at a glance, gives valuable information as to patient's cooperation in keeping appointments.

THE HISTORY CHART

The history chart, the most elaborate of them all, when filled in contains much

TEETH AND MOUTH

SIZE—macrodontia, megadontia, microdontia. COLOR—No. 17C : defects:
NUMBER—normal, redundancy, deficiency, (congenital or acquired).
POSITION—orthognathous, mesognathous, prognathous: torsiversion, transversion, perversion.
FORM—deficient, redundant, germinated, dentigerous cyst. PULPS—infected none ; removed none.
STRUCTURE—sclerotic, malacotic, hyperplastic, ~~fluetic~~ Lustic
GUMS—{ Color: pale, pink, red, dark red, bluish.
Structure: soft, hard, deficient, medium, abundant.
Health: normal, gingivitis simplex, chronic, atrophic, hypertrophic.
PALATE—Width: iii to iii 2,7 ; or 3 to 3 ____ : 6 to 6 3.0 ; HEIGHT: 6 to 6 to vault 2.5
UVULA—Size: normal, elongated, large, small, bifid. HEALTH: normal, uvulitis, edematous.
TONSILS—normal, inflamed, hypertrophic, scar-tissue. rem GLANDS: normal, enlarged.
TONGUE—normal, microglossia, macroglossia, ankyloglossia.
ORAL LESIONS—gingivitis, stomatitis, pulpitis, pericementitis, osteitis

CARIES — RESTORATIONS — XTRACTIONS — RADIOGRAPHS — ADVISED

TEETH ERUPTED 6 V IV 3 2 1 | 1 2 III IV V 6
6 3 2 1 | 1 2 3 4 V 6

MEASUREMENTS

BODY—HEIGHT 51"
WEIGHT 53#
HEAD LENGTH (g to op) 17.2
BREADTH (eu to eu) 14.5
CEPHALIC INDEX 84.30
CLASSIFICATION: Brachicephalic
FACE—LENGTH (g to gn) 10.7
(g to sto) 6.4
(g to n') 6.7
(g to m) 4.8
(gn to rTi) 3.4
BREADTH (zy to zy) 9.9
ORAL FISSURE—LENGTH (ch to ch) 4.0
HEIGHT (ls to li) 1.9
MANDIBLE—WIDTH (go to go) 9.2
GONIAL ANGLE—RIGHT 130°
LEFT 130°
MAXILLA—WIDTH (m' to m') 4.2

OBSERVATIONS

GENERAL HEALTH—good, fair, poor. NUTRITION—normal, subnormal, supernormal
TEMPERAMENT—phlegmatic, intermediate, nervous.
VOICE—normal, lisping, non-resonant, stammering, dumb; congenital, acquired
VISION—normal, imperfect, blind; congenital, acquired.
EYES—normal, microphthalmia, intermediate, macrophthalmia.
EYE COLOR—pale blue, blue, gray, light brown, medium brown, dark brown, black (Note if color differs in two eyes.)
EARS—normal, malposed, malformed, macrotia, intermediate, microtia
HEARING—normal, imperfect, deaf; congenital, acquired.
HAIR, COLOR—albino, flaxen, yel. brown, med. brown, dark brown, black, light red, bright red, dark red.
HAIR, FORM—straight, wavy, curled. Quantity—abundant, medium, deficient, absent.
SKIN, COLOR—fair, intermediate, brunette, yellow, defects.
SKIN, TEXTURE—velvety, soft, hard, rough, moist, dry, oily.
NOSE—normal, malformed, macrorhinia, intermediate, microrhinia
BREATHING—normal, abnormal-structural, functional.
LIPS—normal, malrelation, malfunction, malformed: abnormal frenum, harelip; macrocheilia, intermediate, microcheilia; procheilia, orthocheilia, opisthocheilia
FACIAL FORM—normal, malformed. MOUTH, macrostomia, intermediate, microstomia.

Fig. 6.—Inside of history chart before folding.

valuable information. It is really an 8 by 10 sheet, but arranged so that, when properly folded, it becomes a double sheet 5 by 8, and fits readily into the pockets. The sheet is folded from both ends, so that when it is in the pocket and the file is open, all the information is readily visible.

The many things listed may seem unnecessary at first, but if one is interested in comparative studies, histories, etc., this proves a very convenient way of handling it.

The front page of the folded chart has, at the upper margin, much the same information found on the examination

chart, and this, together with the outlines on the left third of the sheet, practically takes in all of the information on the first card. It should be kept in mind that examination cards are made out for all patients who come in for examination, while history charts are made out only for those who start treatment.

The middle third is devoted to the history, with reference to the condition of teeth of relatives, the health of the patient, feeding, eruption of teeth, etc.

The right third deals with etiology, listing the more common suspected causes, with plenty of space for adding others.

Along the lower margin for about one inch in width, and across the sheet, we have special spaces for the name and address of parent and patient, telephone number, anchor teeth sizes and model number.

Besides, we also have blocked off here the days of the week, months of the year and days of the month. This margin

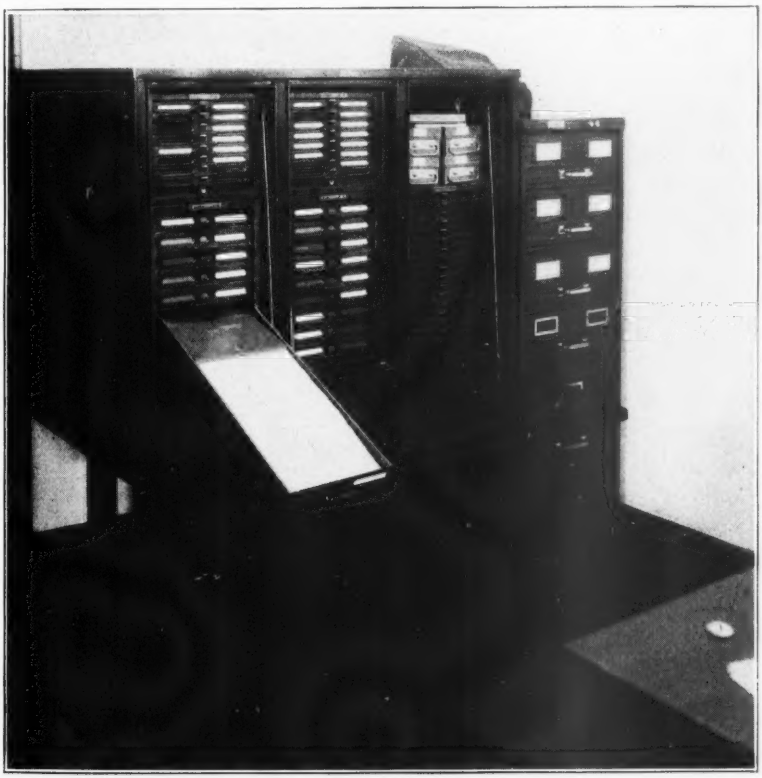


Fig. 7.—The Kardex safe and file open with one tray pulled out, with the filing cabinet to the right.

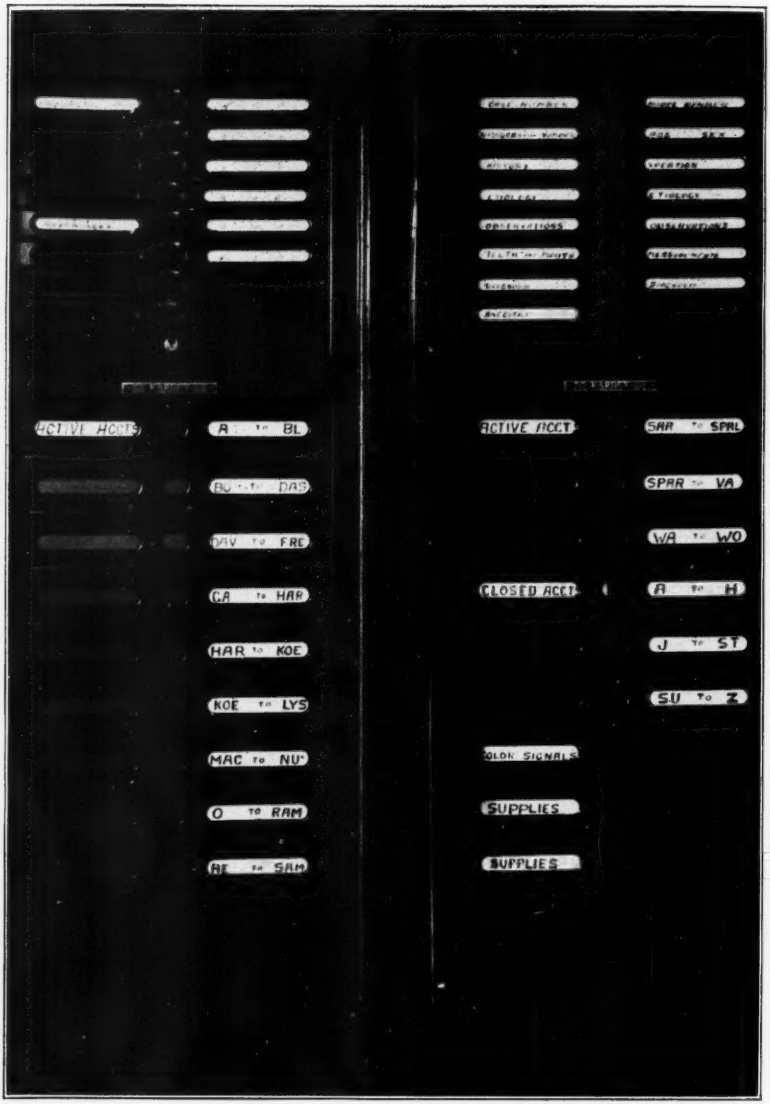


Fig. 8.—A close-up view of the file showing arrangement.

Fig. 9.—View of one of the trays, open to show arrangement of records in pockets of file.

becomes the visible margin in the file; hence, the dates for signaling. (Fig. 5.)

Turning to the inside of the history chart, which is readily done, when it is

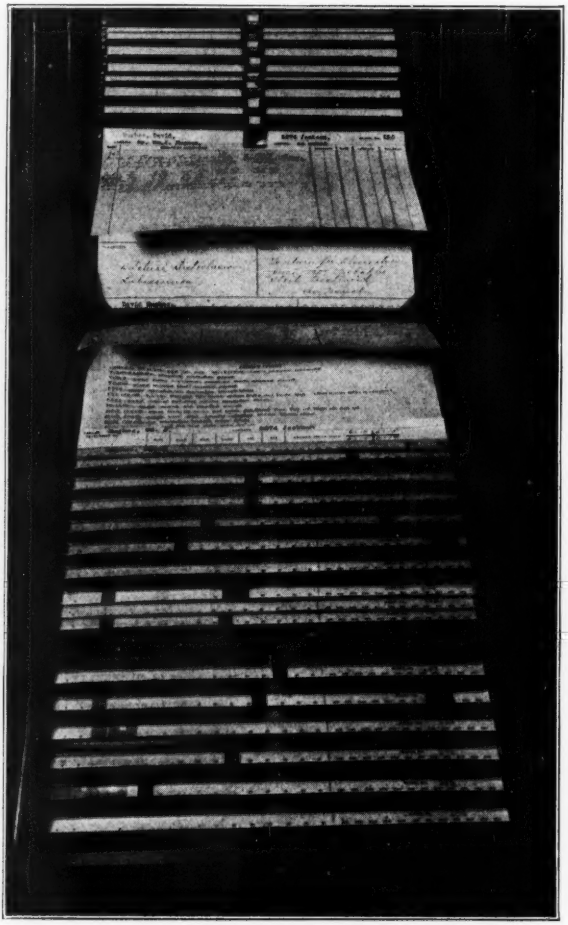


Fig. 10.—Opened tray shown in Figure 9, with history chart opened; also the ledger card lifted to show the examination card beneath.

in the pocket of the file, we see at the top a general heading "Teeth and Mouth." Under this are listed size, color, number, position, form, structure, pulp, condition of gums, palate, uvula, tonsils, tongue, oral lesions, glands, caries, extraction advised, restorations, roentgenograms advised and teeth erupted.

Under each of these subheadings, we

have further divisions, so that it is only necessary to underline the particular condition found. For instance, we find the following divisions under the subheading "Size": macrodontia, mesodontia, microdontia. If the patient has unusually large teeth, we underline the word macrodontia.

About the middle of the page, we find the outlines for quite a number of measurements, including body height and weight, head length and breadth, various facial lengths and breadths, oral fissure length and height, maxillary and mandibular width and gonial angle measurements.

Below this, we have a column of observations, relative to health, temperament, voice, vision, ears, skin, hair, breathing, nose, lips, mouth and facial form, all again subdivided so that only underlining is necessary. (Fig. 6.)

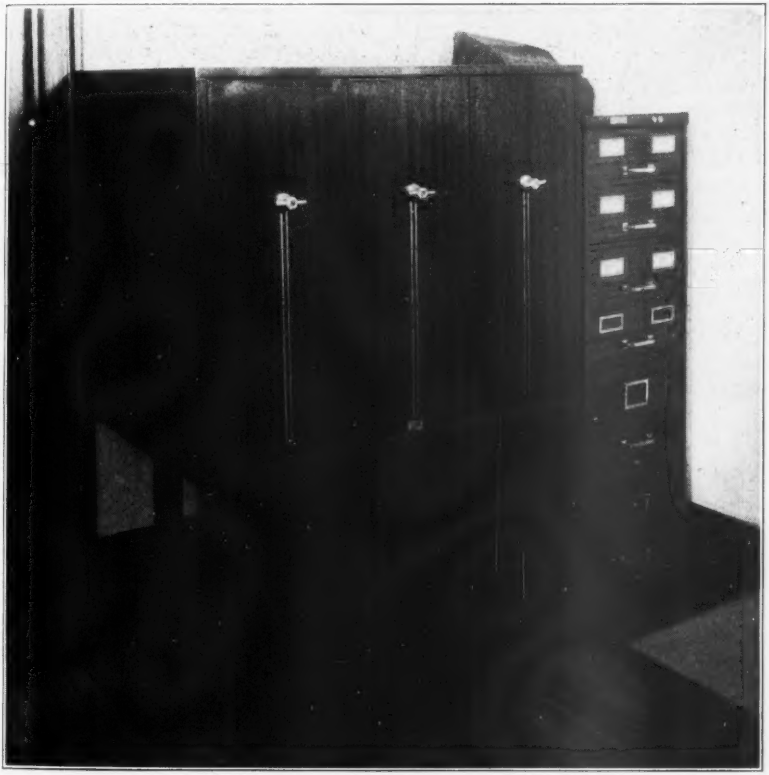


Fig. 11.—Kardex closed protecting the records against fire.

THE KARDEX FILE

Three cards — examination card, ledger card and history chart—consti-

tute the information we have as it pertains to the individual patient, and these are in due time placed in the Kardex file.

The file is really a metal cabinet, into which fit a number of trays, which readily slide forward, making the contents visible. (Figs. 7 and 8.)

The pockets in each tray are fastened at the upper margin and so arranged that a margin, called the visible margin, is always exposed to view, the upper pocket never fully overlapping the one beneath it. (Fig. 9.)

The history chart is placed in the lower half when the file is open, while the examination and ledger cards are placed in the upper half. (Fig. 10.)

The Kardex pocket has a transparent margin about three-eighths inch wide, and when the cards are placed therein, this transparent margin makes the margin of the card visible. The card is held in place by shoving the upper corners through little slots provided for that purpose.

It is the visibility of each margin that makes the system so efficient. When the file is closed, we can read the name of the patient through the transparent margin and, by a mere flip of the index finger, lay before ourselves the full record of a case.

As stated, the ledger and examination cards are placed in the upper half of the open file, the examination card being first, and then the ledger card. Here again, the visible margin makes it possible to locate the account, whether reading up or down, with the file open or closed.

As stated, the examination cards are made out for all patients who come in for consultation. These cards are placed in the file in alphabetical order, and can therefore be readily found if reference need be made to them.

It is quite a satisfaction to have such a card handy a few years later, when patient returns. The condition at the time of the previous visit is written on the card, and if the advice given has not been accepted, it is easy to place the responsibility where it belongs.

The trays can be had in various depths, but for the routine of filing, such as the index and the examination cards, a shallow tray is sufficient. Where the "build up" becomes a factor, as in the ledger cards, deeper trays should be had. (Fig. 8.)

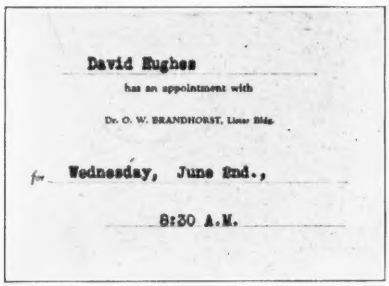

David Hughes
has an appointment with
Dr. O. W. BRANDHORST, Liner Bldg.
for Wednesday, June 2nd.,
8:30 A.M.

Fig. 12.—Card given to the patient when a special appointment has been made.

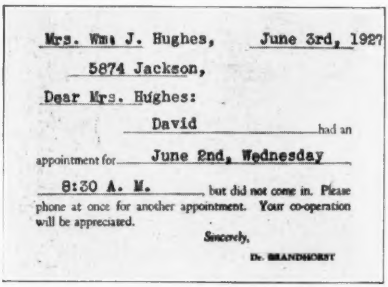

Mrs. Wm J. Hughes, June 3rd, 192?
5874 Jackson,
Dear Mrs. Hughes:
David had an
appointment for June 2nd, Wednesday
8:30 A. M. but did not come in. Please phone at once for another appointment. Your co-operation will be appreciated.
Sincerely,
Dr. BRANDHORST

Fig. 13.—Card mailed to the parent when the patient has failed to keep an appointment.

The files are so built that they fit into a safe made for the purpose. This can be closed, and thus the records are protected against fire, which, of course, is quite important. (Fig. 11.)

THE COLOR SIGNALS

One of the most interesting and efficient things about this system of record keeping is the color signals. The visible margin of each pocket enables one to use small transparent color indicators which slip over the edge of the card and are held snugly in position. The possibilities with various colors, shapes and sizes of indicators are simply astounding.

In our office, we use dark red to refer to appointments; pink, prospective patients and their future appointments; blue, delinquent accounts; yellow, removal of appliances, etc.

Besides the different colors, we can also obtain various sizes and shapes of these indicators in the same color. Re-

Fig. 14.—Tray with the various color signals in place. Each color and size indicates a definite thing, so that one can take in the entire situation at a glance.

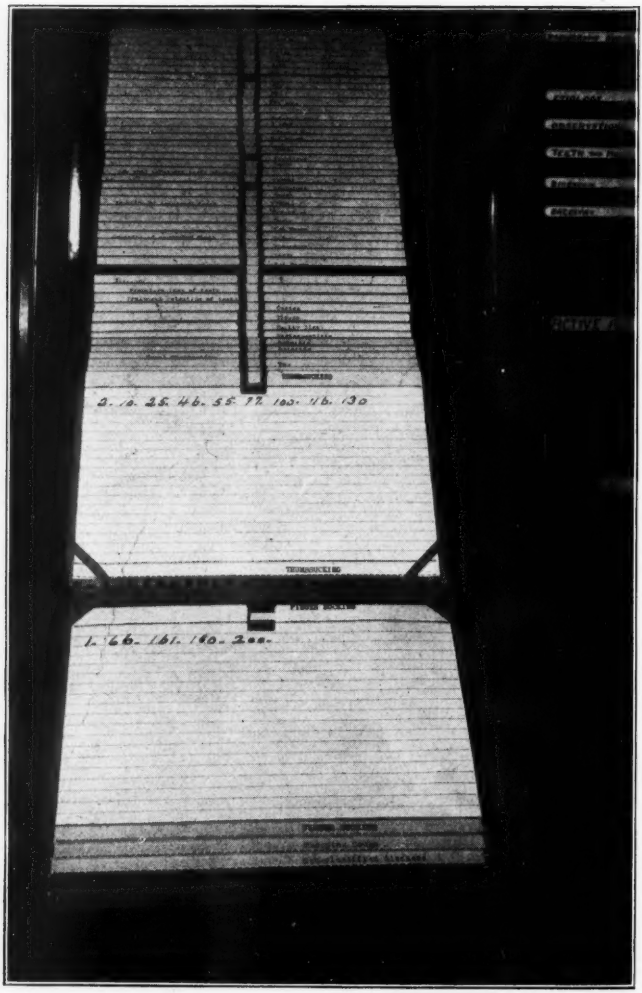


Fig. 15.—One of the "Index" trays opened to show listings under "Thumbsucking" as an etiologic factor.

ferring to the dark red, we use the one-fourth inch width to indicate the appointment. This indicator is inserted so as to show the day of the week on which the patient is expected to come in.

The patient is given a card (Fig. 12) for a special appointment. If the patient fails to keep an appointment, it is recorded as broken; and a card is made out at once calling the parent's

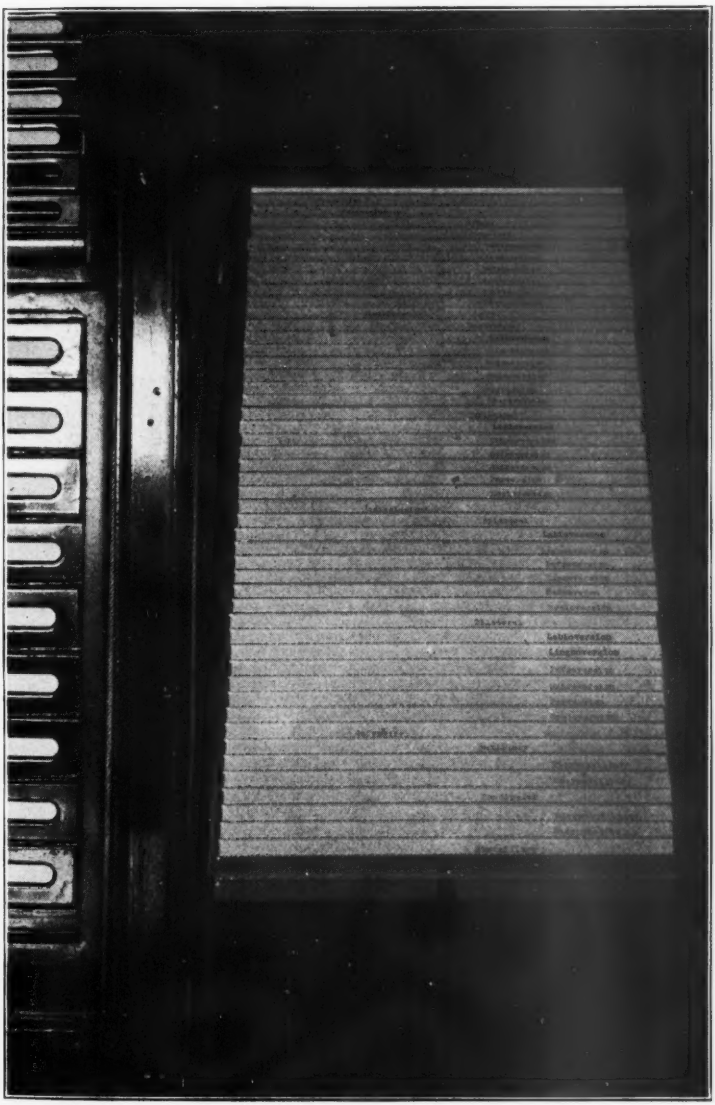


Fig. 16.—One of the "Index" trays drawn out to show the general arrangement of headings and subheadings under "Diagnosis."

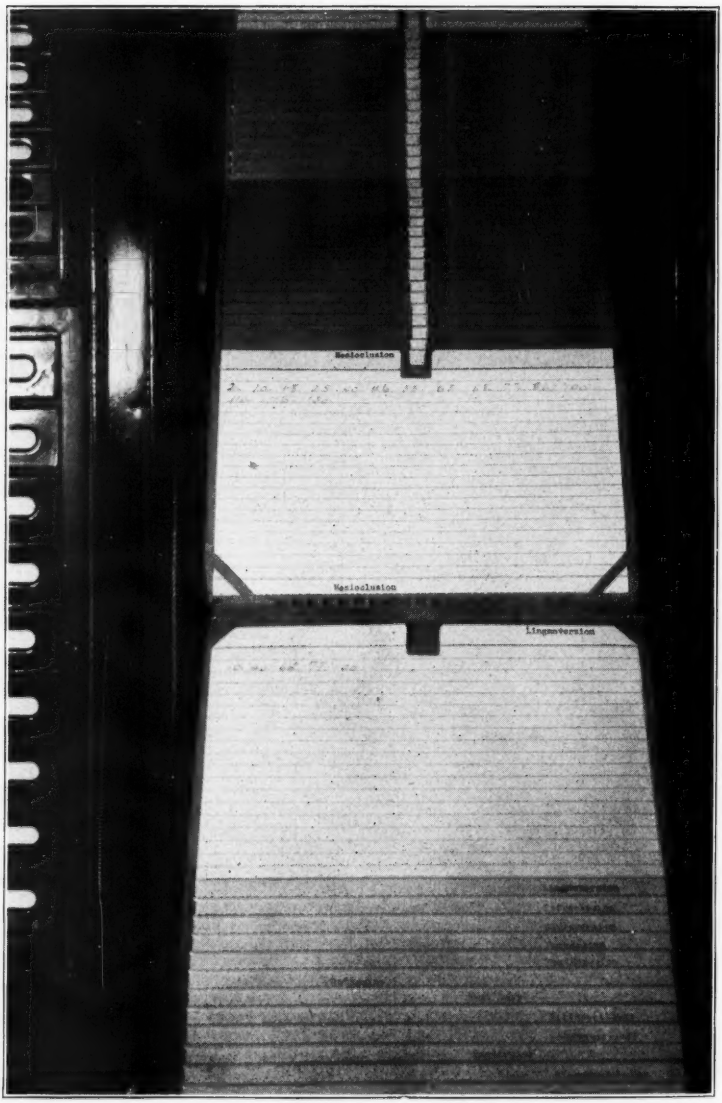


Fig. 17.—Tray shown in Figure 16, opened to show listings under mesioclusion, with linguoversion.

attention to the broken appointment. (Fig. 13.) In order not to forget that the patient has not been in, an indicator, dark red, but one-half inch wide, is slipped into the visible margin.

This one-half inch red indicator is left in place until the patient comes in for the next appointment. This may be seen at a glance. Failing to hear from the patient, we send a second notice to the parent. The one-half inch plain red color signal is changed to one of the same size, but with a round hole in it. This indicates that a second notice has been sent.

Still failing to hear from the patient we write a letter to the parent calling attention to the seriousness of their neglect in cooperating. This is recorded by changing the signal again to one with a square hole in it.

Of course it is seldom that we are annoyed so much as this, with noncooperation of patients. Now and then, we find that even the foregoing correspondence does not bring in the patient. Should this be the case, a final letter is written the parent, advising them that, because of their lack of interest and cooperation, we refuse to

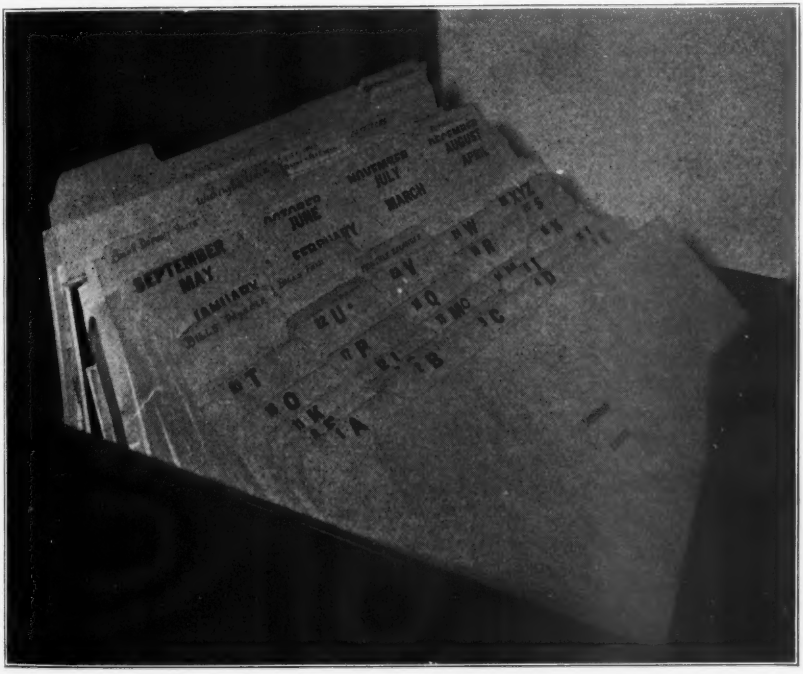


Fig. 18.—One of the drawers of the filing cabinet, opened, showing the alphabetical index for correspondence, the bills payable, monthly balances and such other divisions as there may be need for.

assume any further responsibility. This is recorded by means of a red signal with a slot in it. In due time, the account is then transferred to the closed account file, a record being made of the situation, on the record card.

Similar signals are used to indicate the status of the account, outlined as follows: account delinquent, one-fourth inch blue signal; letter written regarding account, one-half inch plain blue; second letter written regarding account, asking remittance by definite date, one-half inch blue with round hole (this is placed over date indicated in the letter); third letter written on date indicated by previous signal, advising that account must be taken care of at once, one-half inch blue with square hole; account placed for collection, one-half inch blue signal with slot.

Frequently we place under observation patients who have come in for consultation. Here, we use a pink signal. The one-fourth inch pink signal is placed in the visible margin over the month in which the patient is to return. Soon after the first of the month indicated, the patient is notified

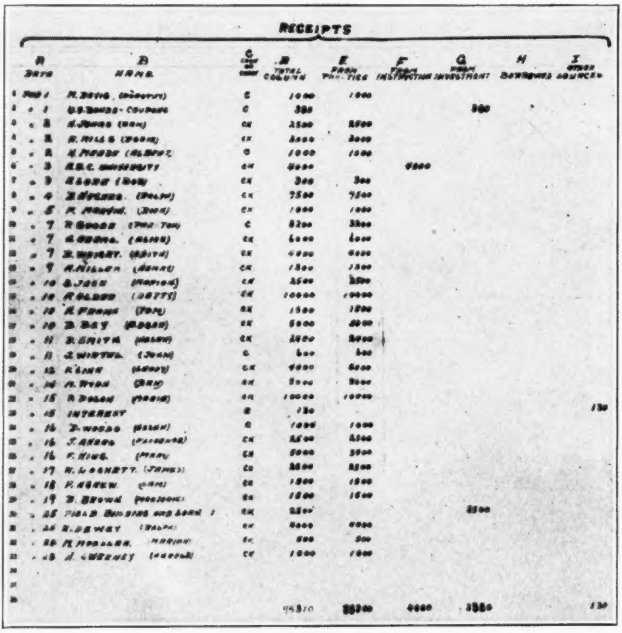


Fig. 19.—Income page of the financial ledger, with items listed in the proper columns.

to telephone for an appointment. This notice is recorded by means of a one-half inch pink signal. If the patient fails to respond to this notice, we assume they are not interested, and no further notice is sent.

Yellow color signals are used to indicate removal of appliances, dismissal of patient, changing of appliances, etc.

Other color signals are used for other specific purposes. All of these signals are placed on the visible margin, and so are readily seen when the file is open. This calls immediate attention to the conditions as recorded. The placing of the signals requires only a few seconds, yet it saves much valuable time by keeping things constantly before us. (Fig. 14.)

THE INDEX

Referring to the information on the history chart, it is of little avail, unless we can so tabulate it so as to make it useful.

There is much of value contained in it, but to go over all history charts each time when we want tabulations, is entirely out of the question. Hence we again use the 5 by 8 cards, horizontally ruled, and index all the information on the history and examination charts.

To do this we make out a card for each heading and subheading. As we then run down the history chart, we write the case or model numbers on the proper card. This gives us the total tabulation at any time. For instance, turning to the heading "Etiology," and then running the finger down to "Thumbsucking," under the subheading "Habits" we find listed on this card the model numbers of all cases giving a history of thumbsucking. (Fig. 15.)

Or under the heading "Diagnosis" we find, under "Mesioclusion," all cases listed of this type, and then we find them further divided into groups showing similar conditions, with a card for each group. (Figs. 16 and 17.)

Special cards are made out to indicate the case number, model number, photograph number and roentgenogram number. These are all in numerical order. Since the other cards show the patient's name, model or serial number, etc., this cross indexing makes it pos-

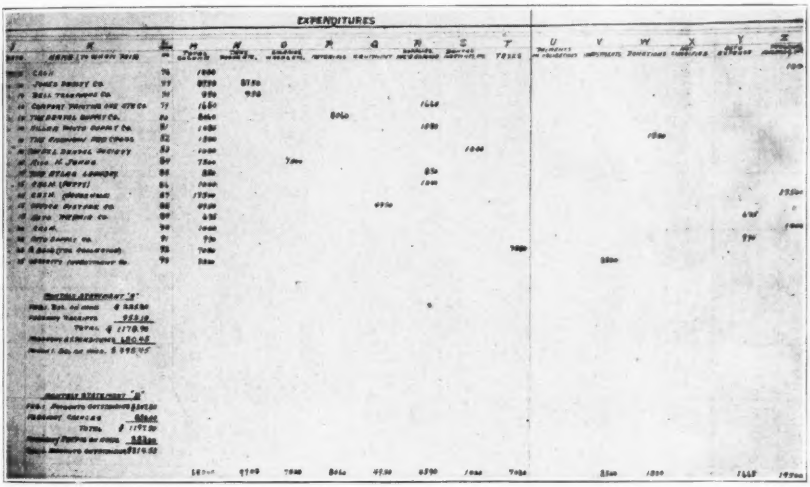


Fig. 20.—Expense page of the financial ledger, with items in proper columns.

sible to look up any information without trouble.

To index all this does not require a great amount of time, and it can be done when time is available. It requires about thirty minutes to run a case through the entire index. At first thought, we might feel that a system with so much detail requires a great deal of time on somebody's part. It has been most gratifying to find that this is not true.

Our old method consisted of filing these various records separately in

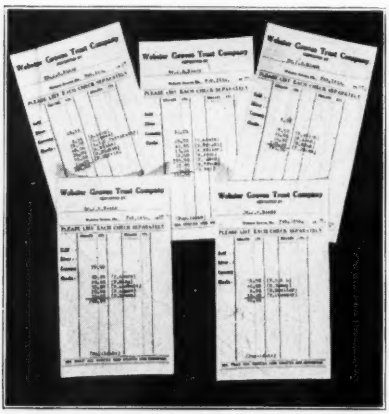


Fig. 21.—Group of the duplicate deposit slips with names written in. (Compare with bank book entries.)

alphabetical order. It usually required several hours to post a day's work in the record sheets. Now we find that it can readily be done in fifteen minutes. Besides the saving of time, we have everything compact, and still more time is saved when we have to refer to our records during treatment.

OTHER FILES

Besides the foregoing, we have files for correspondence, photographs, roentgenograms, bills payable, etc., arranged numerically or alphabetically. To date, we have not been able to find a better method of handling this. (Fig. 18.)

Photographs, roentgenograms and charts are filed numerically and separately for each patient in large envelops in another drawer of this file.

THE FINANCIAL RECORDS

Every good business man believes that he should so tabulate his business that he can, from time to time, get a perspective of it, and know how to plan and what obligations he can assume.

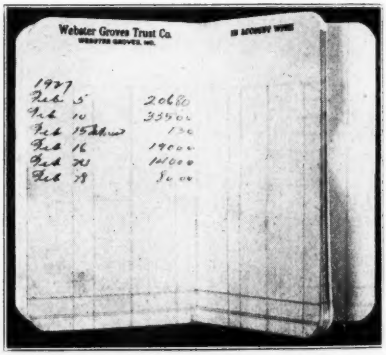
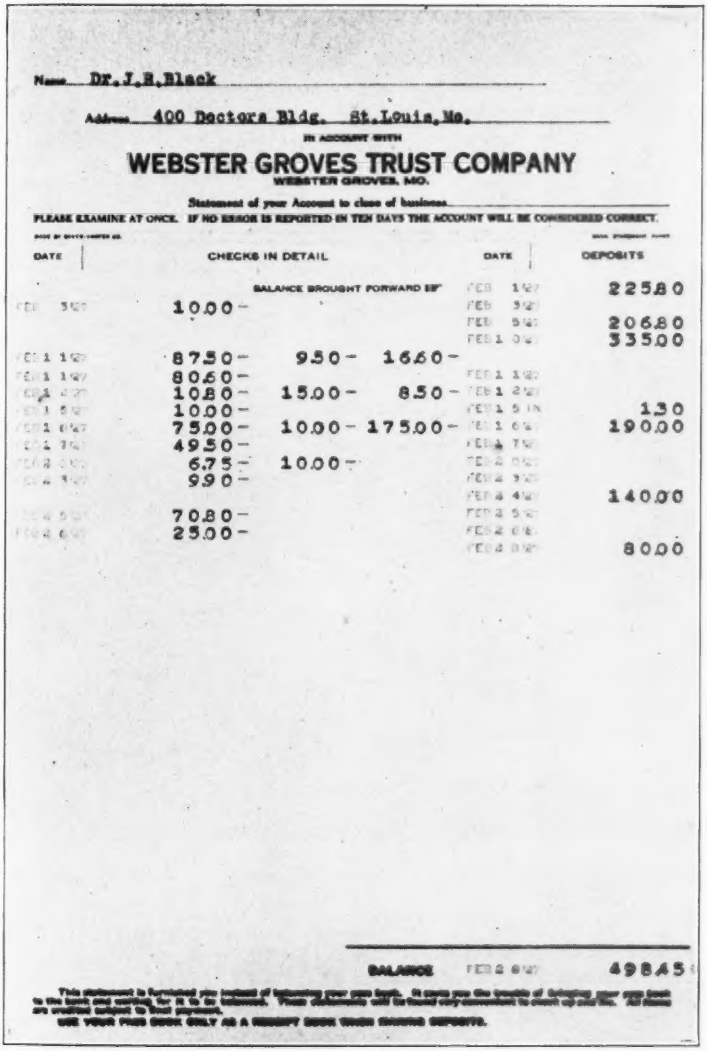


Fig. 22.—Entries in bank book. (Compare with deposit slips [Figure 21].)

One of the first essentials here is to keep a record of the receipts and disbursements. As the Federal Government has seen fit to make certain demands of us as regards income tax returns, the following has been worked out as a method for tabulating the various items in such a way as to make it easy to ascertain the totals for ourselves, as well as for the Government.

In planning this, our thought was to enumerate items as nearly as possible according to the questions in the in-



Name Dr. J. H. Black

Address 400 Doctors Bldg. St. Louis, Mo.

IN ACCOUNT WITH

WEBSTER GROVES TRUST COMPANY

WEBSTER GROVES, MO.

Statement of your Account to close of business

PLEASE EXAMINE AT ONCE. IF NO ERROR IS REPORTED IN TEN DAYS THE ACCOUNT WILL BE CONSIDERED CORRECT.

DATE	CHECKS IN DETAIL			DATE	DEPOSITS
	BALANCE BROUGHT FORWARD				225.80
	10.00 –				
					206.80
					335.00
	87.50 –	9.50 –	16.60 –		
	80.60 –				
	10.80 –	15.00 –	8.50 –		
	10.00 –				1.30
	75.00 –	10.00 –	175.00 –		190.00
	49.50 –				
	6.75 –	10.00 –			
	9.90 –				
					140.00
	70.80 –				
	25.00 –				
					80.00

BALANCE 498.45

This statement is furnished you instead of returning your cash book. It saves you the trouble of balancing your cash book as the bank will verify for it to be correct. Your statement will be found very convenient to check up this list. All items are credited subject to final payment.

USE YOUR PASS BOOK ONLY AS A MEMORY BOOK WHEN MAKING DEPOSITS.

Fig. 23.—Monthly bank statement, showing debits and credits, and balance in bank.

come tax return sheet. We therefore selected the loose leaf form No. L2720½, because it, of all the stock forms seen, came nearest to supplying our needs. This contains nine columns on the left side of the ledger for receipts and seventeen on the right side for the expenditures. These sheets are

kept in a loose leaf binder of proper size.

On these pages, we propose to place all items of receipts and disbursements, keeping them in their respective columns as follows:

RECEIPTS

Column A—Date of receipt
Column B—The source
Column C—Indicates method—C=Cash; Ck.=Check.
Column D—Total column—all items received are listed in this column.
Column E—Receipts from practice
Column F—Receipts from instruction
Column G—Receipts from investment
Column H—Borrowed
Column I—Other sources

The headings, of course, can be changed to meet one's particular needs. As stated, all receipts are listed in column D, and from this are distributed to their respective columns.

When all have been entered or the page is full, each column is footed, and the sum of the footings of the columns E, F, G, H, and I will equal the footing of column D, if the recording is correct. (Fig. 19.)

The same arrangement is used for disbursements:

Column J—Date of payment
Column K—To whom paid
Column L—Check number
Column M—Total Column
Column N—General overhead (rent, telephone, etc.)
Column O—Salaries and wages
Column P—Materials
Column Q—Equipment
Column R—Supplies and incidental expense
Column S—Dental meetings and societies
Column T—Taxes
Column U—Payments on obligations
Column V—Investments
Column W—Donations
Column X—Not classified
Column Y—Auto expense
Column Z—Personal

Here again, the sum of the footings

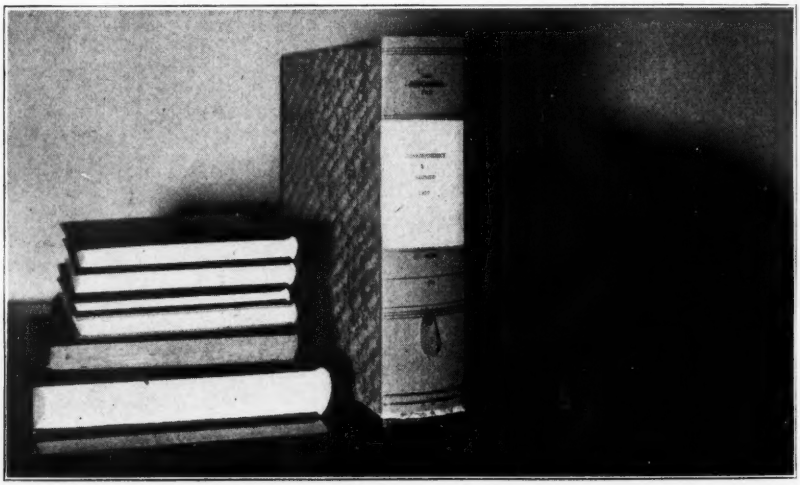


Fig. 24.—Letter filing box containing the year's business records, arranged in alphabetical order.

of columns N, O, P, Q, R, S, T, U, V, W, X, Y and Z must equal the footing of column M.

This may look complicated, but in reality it is quite simple. One of the essentials is that all receipts must pass through the bank and all payments be made by check. When this is done, it is not necessary to list each disbursement at the time it is paid. It can best be handled at the end of each month, and listed from the stub of the check book.

The receipts must be entered in the total column, at least when received, or some other arrangement must be made for listing, until it can be transferred to the ledger.

At any time, totals can be made, but we have found it quite convenient to carry each month separately, and, December 31, add together the twelve monthly footings of the various columns. This requires only a few minutes, and the year's business is properly tabulated, and easily carried to the income tax sheet. (Fig. 20.)

THE BANK BOOK, DEPOSIT SLIP AND BANK STATEMENT

In order to be able to check any possible errors and to be sure that all accounts are correct, we take the special precaution of making out a duplicate slip for all deposits, and these are duly filed away. On these duplicate slips, we list the maker of the check beside the amount. Any question arising relative to checks can readily be answered on the basis of these deposit slips. The footings of the deposit slips should correspond with the entries in the bank book, and the total amount deposited should correspond with the total entered in column D of the ledger. (Figs. 21 and 22.)

The bank sends us a statement of our account on the first of each month, and, assuming that the accounts are correct, this bank statement really becomes our trial balance, and our balances must check with it. (Fig. 23.)

MONTHLY STATEMENT

For our own information, we then make out a monthly statement of our own. Here, we take the balance on hand on the first day of the previous month, add to it the month receipts and subtract from the total the disbursements for the month. The remainder represents the balance for the first of the present month. This should check with the bank balance, due allowance being made for checks outstanding. This is monthly statement "A." (Fig. 20.)

Another statement, called monthly statement "B," is also made. Here, we take the total of the accounts outstanding on the first of the previous month (the balances shown in the individual account file), add to this the charges entered for the month, subtract from it the receipts, (total of column E) and we have the accounts outstanding on the first of the present month. (Fig. 20.)

All this is valuable information, fully worth the effort. It requires only a comparatively short time to make these up if care has been exercised in all accounts.

Yearly statements can readily be made from these monthly statements, and this is done on January 1 of each year.

Also about January 1 of each year, we take an inventory of our office equipment and supplies. We are not content to suppose that we have so and so.

When the year's business has been duly closed on December 31, the bills

paid, the correspondence, the large ledger sheets, the yearly statements, the inventory, the bank book, deposit slips and later the duplicate income tax return sheets are duly filed in a letter filing box, in alphabetical order. This constitutes the year's records, and any necessary reference to it is readily made. (Fig. 24.)

From the foregoing, some idea may be had of a complete system of records. As a whole, they may at first seem too elaborate for general use. Yet they are fundamentally sound principles and are not at all out of reach.

The time required for all this is insignificant compared to the value gotten out of it. It is of the greatest satisfaction to know that we have all our information at our finger tips at all times. The importance of it all can readily be seen and the joy of it spurs one on to greater things.

The many items contained in this paper are the result of observations and suggestions from friends, and to them I express my appreciation for their suggestions.

DISCUSSION

J. D. Williams, St. Louis, Mo.: You have just listened to a paper the full appreciation of which will not be had until it has been published and can be reread and studied. The matter of records is a very important one and I agree with Dr. Brandhorst when he says that it is probably one of the most neglected essentials in our daily practice. Unfortunately, few of us have had any great amount of business training and the matter of keeping records is merely applying good business principles to our profession. Dr. Brandhorst has presented a system of record keeping which is indeed complete, especially so for the individual who is doing research work or teaching and requires detailed information at all times. The loose leaf or card system is no doubt the most used today in the practice of dentistry. There are many different varieties of record systems on the market, some good, but a great many of them not worth having. No system is of much use unless it is kept up to date. Dr. Brandhorst has chosen the Kardex file and has very cleverly adapted it to an orthodontic practice. The same file can be applied to the general practice of dentistry with equally good results. In studying his system of records, I would say it was more especially adapted to a large office, one where two or more men are working and caring for a large number of patients. In a smaller or one man office, I believe that the best type of keeping record is the manilla folder of letter size in which all correspondence, roentgenograms, photographs and history records pertaining to a case can be kept in the same folder. These folders can then be filed in an ordinary steel letter file, and from 150 to 200 active cases can be well cared for in a single drawer. With Dr. Brandhorst's system, it is necessary to have a letter file in addition to the Kardex safe; and while this may not mean much in some offices, to those of us who are renting offices in modern buildings the question of space is one to be considered. There are many things that Dr. Brandhorst mentions outside the filing system that are especially good. His history sheet is complete. I think many of us are rather lax in this particular. We do not delve into the history of the case enough before starting treatment. Consequently, we are sometimes wrong in our diagnosis, when, if we had gone more thoroughly into the history, we could have avoided considerable difficulty. His method of folding these sheets and adapting them to the Kardex file is to be commended. I cannot see the reason for using the examination card. It seems to me that the history sheet can be made to answer for this purpose. Since, on examination, we usually try to make a diagnosis, there are many questions on this history sheet that should be asked at the first examination of the patient. So it seems that the examination sheet is rather superfluous and probably some time could be saved by using one sheet for both purposes. Color signals are especially applied to the Kardex system of filing, and Dr. Brandhorst has adapted them to his practice with considerable success. There are many forms of these signals on the market, one known as the Graffco. They come in different colors and can be secured

from any good stationery house. We have used a follow-up system in our office for several years and use Graffco signals for this purpose. Dr. Brandhorst has worked out a splendid system of cross indexing which can be applied to almost any form of records by using a small card file for this purpose. I feel sorry for the man in the practice of dentistry who does not keep a record of his finances. There are many failures among dentists largely due to this fact. While we are professional men, we cannot evade the fact that we make a business of our profession. We have invested a great deal of time and money in mastering the science of dentistry; we expect to make a livelihood out of it, and, in order to do so, we can no more evade the fundamental laws of business than can any strictly commercial enterprise. If a man is not capable of opening a set of books for himself, it would be well worth his time and money to employ an accountant to do this for him. Dr. Brandhorst's records are good, but I would go a step farther and include all my financial investments in them, so that, when a trial balance is taken, I would know my net worth. I would also suggest that, in addition to the patient's name on the duplicate deposit slip, the name of the bank on which the check is drawn be included. We have found it convenient, on one or two occasions, to have this information. I know no better form of indoor sport than to see the amount under the heading "Net Worth" increase month by month, and there is no way of enjoying this thrill until proper records are kept.

Dr. Brandhorst (closing): I believe that Dr. Williams will find this system equally applicable to both the small office and the large office. Mine is not a large one. The statement made as to these accounts being kept in files refers to the way we kept them previously, and it is reaching in and getting them out to make our entries that takes so much time. I am always looking for two more days in the week, so I am trying to gain them by the time it takes to get these records out. The examination and history chart combination eliminates the examination card. I have not yet found it practicable to fill in a complete history chart for each case that comes in. That is ideal, and I hope that we can get around to that some day. The Kardex file or card system can be used in any system. We can use this same outline for any card file, and without a doubt you can get some other signals that are equally good. I have found this system so convenient that I am partial to it. You can use similar files, placing them in alphabetical order; but I am again considering the time we save in placing them in this form. I agree with Dr. Williams that the bank deposit slips should contain the name of the bank.

ORAL DIAGNOSIS*

By EARL H. WESTENHAVER, D.D.S., Kansas City, Mo.

BEFORE entering into a discussion of the main subject of this paper, I shall call attention to some of the various things which are as important to the oral diagnostician as they are to the internist.

Some of you may doubt the necessity of giving so much time and placing so much stress on a general observation when we are speaking of oral diagnosis, and you may ask yourself the question, What relationship has the general condition of a patient to the practice of oral diagnosis, prognosis and treatment?

If you have any such ideas, or if you have not given this subject thought from

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventieth Annual Session of the American Dental Association, Minneapolis, Minn., Aug. 21, 1928.

the standpoint from which I see it, I ask you to turn over a new leaf and start anew. Let us awaken so that the medical fraternity will be glad to recognize us as a scientific profession with high ideals. Only by cooperation will we be able to attain the highest degree of success in our service to humanity.

The subject of oral diagnosis is not a new one, by any means, but it is one that will always permit repetition and discussion. We are not advocating anything new or sensational. Instead, we are asking you to observe and record your findings in a systematic manner so that they may be interpreted by other members of the profession and not be confined to mysterious markings on a card intelligible to ourselves only. It is true we have been practicing diagnosis in various degrees of efficiency; but as our knowledge of disease prevention grows, we must recognize the importance of broadening ourselves in the professional realms of dentistry and medicine. in order that we may best serve the public as guardians of health. This being true, we must have some standard routine to follow in order to arrive at a satisfactory and intelligent end. The subject of oral diagnosis does not mean that we should confine our diagnosis or observation entirely to the oral cavity. However, we are not expected to pass judgment as to whether or not a patient has a diseased gallbladder, a gastric ulcer or an appendix which should be removed, but there are many deviations from the normal that we should observe and record, which, if attention is directed to them in the incipient stages, do not have a chance to become chronic and possibly incurable in later years. Observation is the first step toward a successful oral diagnosis. It is not the intent of this paper to go into such an elaborate classification as to make it impracticable, but instead, to give a concrete foundation which you may take home and use in everyday practice. Our motto should not be "How much can we do?" but "How well can we do it?" In these days of speed everywhere about us, we have a tendency to rush into the great whirl of human industry, taking a short cut many times. Sometimes, we may be successful and sometimes not; therefore, we should consider well before advice is given, making observations so that we may know a sick patient from one who is well.

The first observation or question to ask ourselves is, Is patient clean? This includes hands, face, scalp, clothing and general body hygiene. Owing to the lack of body hygiene, parasitic diseases may be present, and from these observations, we at once form an opinion as to the habits of such patients, which gives us the first step toward an oral diagnosis, prognosis and treatment to be recommended. Again, we desire to emphasize the fact that this is a paper on oral diagnosis, and not on internal medicine and that we are not attempting to diagnose from the standpoint of internal medicine, but merely to "observe" and record our observations and to refer cases for physical diagnosis to our medical allies. If a patient presents himself in such condition, we can then be assured the mouth will not show any better care than other parts of the body; therefore, we should be guided as to the type of restorative work to be placed in such a mouth.

Our next question is, Does the patient have the appearance of good health? During this observation, we note first, whether the patient is anemic, underweight or overweight or cachectic. Such conditions as these are easily noted, and

surely the patient's attention should be called to any such existing symptoms and be referred for diagnosis and treatment. It happens many times that we see the patient long before he consults his physician, and if we point out the necessity of consulting the latter, the patient usually follows our advice. In cases such as these, we would not attempt any difficult or prolonged operative technic until we have a knowledge of the underlying factors which might be responsible for such existing symptoms.

Age: Why do we consider age? Because many changes occur during the various periods of life, and we think of arteriosclerosis, heart and kidney diseases and recuperative powers of such individuals. Other diseases might be taken into consideration, but these are the chief ones of interest to us. We should be guided very cautiously as to drugs prescribed and work to be done for patients who have reached the age at which they might be subject to any of the conditions mentioned.

Height and Weight: Underweight and overweight many times can be corrected by calling the patient's attention to the fact that he is possibly eating too much or too little of the proper foods, or that the condition may be due to some endocrine disturbance. In any event, such existing conditions should be thoroughly checked up by his physician and the cause determined, if possible, to make the necessary correction.

Walk: Any deviation from a normal walk may easily be observed and it may indicate locomotor ataxia, encephalitis, paralysis, lethargy, bone disease (rickets), diseases of the joints (arthritis) and spinal diseases. Such a patient may be suffering from syphilis, and it surely would be important for us to make such observations and records, not only to protect the patient, but also to safeguard ourselves.

Speech: Is it impaired? If so, is the condition congenital or acquired? Such conditions are cleft palate, posterior nasal disease, sinus disease, pulmonary disease, due to tuberculosis, and laryngeal and central nervous system diseases caused by syphilis. All these play an important rôle in our foundation for a final diagnosis. If our patient shows an impaired speech, it most certainly is our duty to attempt a diagnosis as far as we are limited. We have stated here that we should attempt a diagnosis as far as we are limited, and here again it must readily be seen that the cooperation of the physician is of utmost importance.

Muscular Tremor: Why should we consider such symptoms as these? Possibly the patient is suffering from hyperthyroidism, paralysis, muscle weakness or nervousness. We should not attempt any long operative technic on such cases without first having a diagnosis. This is just as much of a safeguard for the patient as it is a protection for ourselves, and a guide by which we can govern our methods of treatment.

Color: This is indeed an important condition, as the color may be impaired by anemia, chronic infections, hemorrhage, wasting diseases (malignancies), undernourishment, heart or pulmonary diseases, jaundice or other diseases of the liver. Flushing of the face may be transitory. In many cases, when the patient is excited, he shows a marked flushing, which passes off in a few minutes. This does not necessarily mean that a pathologic condition exists.

Facial Outlines: Are the outlines symmetrical? If not, are they congenital or acquired? These conditions may

be due to edema caused by infected teeth, nasal sinusitis, chronic interstitial nephritis, heart, rarely, new growths, tumors, malignant or benign, local infections, hemihypertrophy and hemiatrophy. All these conditions mentioned are deviations from normal, calling for aid.

Thyroid: Is it enlarged? The conditions may be benign adenoma, goiter, or hyperthyroidism, other symptoms substantiating the diagnosis.

Facial Eruptions: Frequently, we come in contact with patients who have eruptions on the face: acne, boils, tuberculosis, syphilis, ringworm, barber's itch, herpes and other eruptive diseases.

Glands of the Neck: These glands may be enlarged by oral infections, disease of the tonsils, nasal sinusitis, ear infections, tuberculosis, Hodgkin's disease, syphilis, lukemia, or lymposarcoma.

Nose: Is it straight or crooked? Is the shape congenital or acquired? It may be impaired by fracture, nasal or accessory sinus disease, tumors or malignancies.

Eyes: Are the pupils normal? Do they react to light or do we have a fixed pupil, as in case of Argyll-Robertson pupil? Are they prominent or unusually so? The prominence may be normal or it may be caused from pressure due to tumors or exopthalmic goiter, or it may be due to diseases and growths in the maxillary sinuses.

Scars on Neck and Face: These may be due to accident, surgical treatment or multiple contraction in cervical glands, which often means tuberculous infection for some previous years.

Lips: Are they normal? anemic, cyanotic, thick, harelip, scarred? Or are there any other deviations from the normal? Radiating lines from the corners of the mouth (in children) are frequently signs of syphilis. (Rose.[1])

Hair or Beard: Is the growth normal? If not, there may be some endocrine disturbance (principally of the pituitary gland).

Respiration: What about respiration? Is it normal or labored? It may be impaired by heart disease, lung or pulmonary disease, obstructions in the air passage, such as tumors, and asthma.

Dental Arch: Is it normal? High or low? It may be altered by adenoids, malposed teeth, by any obstruction of the posterior nares in childhood, by injuries, tumors or surgical interference.

Mucous Membrane: Is it normal or anemic? Cyanotic or hyperemic? It may be altered by chronic lead or mercurial poisoning. Also, there may be present ulcers (cancer), tuberculosis, syphilis or malignancy.

Salivary Glands and Ducts: Are the glands enlarged? Do we have an infection? If enlarged, is there an obstruction in the ducts (ranula)? Is the saliva thick and ropey or watery? Is there a normal amount of saliva? Is there excessive odor, if any? The amount and consistency of saliva should be taken into consideration by one who is constructing artificial dentures. (Campbell.[2])

Gums: Are they normal or do they show recessions, pyorrhea, atrophy, hypertrophy, leukoplakia, Vincent's infection, tumors (epulis) or any other deviation from normal?

Tongue: The tongue should be observed carefully for some of the follow-

1. Rose: Physical Diagnosis, St. Louis: The C. V. Mosby Co.
2. Campbell, D. D.: Dental Prosthetics, St. Louis: The C. V. Mosby Co., 1924.

ing conditions: coating, roughness, fissures, smoothness, tremors, (due to weakness or hyperthyroidism, central nervous system diseases, syphilis, symmetrical atrophy and ulcers). Are the papillae normal or atrophied, as in pernicious anemia, or are there any signs of eruptive diseases, such as scarlet fever or measles?

Foul Breath: This may be caused by bad teeth and diseased gums when food particles are permitted to remain in the interproximal spaces. Diseases of the nasal cavity such as atrophic rhinitis, diseases of the throat, bad tonsils, pulmonary gangrene, diabetes and uremic poisoning. There may be other things which alter the breath temporarily, but those mentioned are of most interest and of diagnostic value to us.

Tonsils: Have they been removed? Are they large, imbedded and filled with caseous masses and pus? Are the tonsillar pillars red or edematous? Are there ulcers present on the surface?

Soft Palate: Is it normal or paralyzed? If paralysis exists, it may be possible that it is due to lesions of the central nervous system.

Uvula: Is it normal, paralyzed, edematous or swollen and red?

Posterior Pharyngeal Wall: Is it clean, or do we find it partly covered with secretion, or anything which might be a result of posterior nasal diseases?

Heart: About the only observation that we can make regarding the heart is the rate or action. Is there a rapid pulse, full and tense, or is it slow, weak and thready? If the pulse is rapid, is the condition due to temporary excitement or exertion, or is it due to some chronic organic disease?

Blood Count: Determination of coagulation or bleeding time is many times necessary when there is a suspicion of anemia, or if the patient gives a history of bleeding (hemophiliac), or in case of chronic infection or any other symptoms which might lead us to believe a disease of the blood exists. The blood chart should show: percentage of hemoglobin, erythrocytes and leukocytes, differential count, polymorphonuclears, eosinophils, mast cells and coagulation time. Of the things mentioned, the clotting or bleeding time is probably that which concerns us more often than any other, and no doubt we might save ourselves from embarrassing conditions if we knew the clotting or bleeding time before doing a surgical operation in the mouth.

Urinalysis: Frequently, patients are submitted to general anesthetics. Surely, a urinalysis does not require much time, and with the many laboratories at our command, this can easily be cared for. We should not make the urinalysis, but simply refer the patient to physician or laboratory.

Wassermann and Kahn Tests: We may be surprised many times if we have such tests made, and in any event no harm can result from such an examination.

Cough: If the patient has a cough, is it acute or chronic? Is it productive or nonproductive?

Teeth: Are the normal teeth present? Do they show complete calcification? Are they malposed in the jaws? Do they show signs of a disturbance in the central nervous system during intrauterine life, such as transverse markings, ridges or notches?

The things that I have been calling your attention to are merely the foundation upon which to rest our oral diagnosis. They are the very conditions that

we should observe; in other words, we should school ourselves to such an extent that all the previous factors mentioned will automatically be observed and a mental picture formed at first sight of a patient. Our examination will now be confined to the oral cavity, of which a general survey should be made, any deviation from normal being recorded. Mead,[3] in his text, gives the following outline for observing the gums and mucous membrane:

Condition	Normal Dry Vivid
Appearance	Normal Pale Red Purple or cyanotic
Recession	Slight Medium Marked
Gingival Border	Normal Thick Loose Ragged
Periodontal Area	Gingivitis Pericementitis Hypertrophy Periodontoclasia Periodontal abscess

If we find, on examination, that the mucous membrane is not in a normal condition, we immediately refer to the previous history, calling to mind the habits of the patient. This many times will aid materially in diagnosis. In the presence of ulcers and their character, such as regularity of outline or, if they are irregular, the character of the base, or if we have swelling of the glands or any discharge connected with such an area, all the associated parts should be palpitated and percussed if we are to give an intelligent diagnosis and one to which the patients are entitled. If pain is present, it is always best to let the patient tell us where the pain is located and give him a chance to explain his idea as to the constancy of the pain. Then we may ask him questions as to whether it is spasmodic, if it is a dull throbbing pain or if it is a sharp lancinating pain, such as we have in forms of neuralgia. If on further examination, we find growths present, we should have a section removed and sent to a laboratory for microscopic examination.

Assured that the various fundamental principles have been observed, we are now ready to make an examination of the teeth, with the final prognosis and treatment to be recommended. In recording our findings, two charts should be used, one showing our findings and the other an outline as to the treatment advised. The charts worked out by the oral diagnostic section of the Kansas City Dental Society have proved very satisfactory. More elaborate charts might have been outlined, but it was thought that if the chart such as I have mentioned here were followed, it surely would be a step in advance of the ordinary and many deficient charts now being used by the profession.

Our examination of the teeth should now be made in a routine manner:

1. Size and shape of the arch. Is the arch narrow and contracted? If so, surely there is or has been an obstruction in the nasal passage, and the result will be reflected in the occlusion.

2. The occlusion. This is given consideration, first, because it may be possible to correct it; secondly, the position of the teeth in the dental arch not only have a definite effect on the liability to caries, but the investing tissues also are more liable to become affected, and, as a result, the teeth may have to be lost.

3. Mead, Sterling V.: Diseases of the Mouth and Jaws, St. Louis: The C. V. Mosby Co., 1928.

3. Number of teeth present. Here, again, we are called on to consider age. Our patient may be young and may not have the entire natural denture; on the other hand, he may have reached an age when a large precentage of people have lost one or more of their teeth.

4. Types or decay present. Our next step should be a close observing as to the prevalence of decay and the character of it. We know that there are marked differences in the types of decay, also its prevalence. Here, again, we must recall some of our first observations, and this time we think of habits, occupation, foods and cleanliness. Any one of these conditions plays, in the majority of cases, a most important part in the general healthy condition of the mouth and teeth. A careful exploration should be made on all surfaces of the teeth. Roughening of the enamel surfaces may often be brought out clearly by a stain or disclosing solution.

5. Transillumination. A thorough examination cannot be made without the aid of transillumination. This may seem to be a broad statement, but at present with all the modern conveniences, why should we attempt an examination and diagnosis without transillumination? We guess enough at best; therefore, we should feel the responsibility keenly enough to employ every means at our disposal to make as thorough a diagnosis as possible. Transillumination will often reveal pathologic conditions which might be overlooked if only the average routine examination were made.

Roentgenography.—Every mouth should have a complete roentgenographic examination, and this may require not less than fourteen intra-oral films, or it may require both intra-oral films and plates made extra-orally. Many times, we find such a swollen and edematous condition in the region of the lower third molars that only plates made extra-orally can be employed successfully. Certainly, it would not be good practice to limit ourselves to intra-oral films in such cases. The roentgenograms will many times disclose conditions which we would not think of allowing to remain when we know that they are present. Attention should be called and a correction made. Think of the many broken roots of teeth which are found, and without any external symptoms. Many dentures are placed in mouths in which roots remain, and any operator, if he had taken the time to make a roentgen-ray diagnosis, would not have placed dentures until the roots had been removed.

Pulpless Teeth.—This condition surely must be given most serious consideration, and here again we must consider complaints of the patient. Much has been written about pulpless teeth, but we are still at sea as to know just when a tooth is safe or when it is a hazard. Do not understand me to say that I classify all teeth in the doubtful column: there are many teeth which we need not hesitate about, the only recourse being to extract them.

Thermal and Electrical Tests.—These tests should not be overlooked. A pulp may be dead, and still the roentgenogram not reveal such an existing condition, so we cannot be sure of any one test but must rely on all collectively.

Casts and Study Models.—It is a well-known fact that study models or casts of a mouth are invaluable to the dentist from the standpoint of a thorough oral diagnosis. The position of the teeth when seen on an articulator appears to be entirely different from that as viewed in the mouth. Here, we have the opportunity to view the teeth from all angles

and to study the occlusion and the direct relationship of the lower to the upper jaw.

CONCLUSION

Let us sum up the medical aspect or foundation upon which failure or success rests, keeping away from the mechanical part until we have given such time and thought to each individual case that we are versed in the general condition of the patient, to insure us that we can next consider the case from a restorative and an artistic standpoint. Much time has been given to the various mechanical designs; many are very elaborate and show great skill, but let us not lose sight of the real keystone in the arch of success and that is to build upon a foundation of security and not one of doubt and frailty. Let us give oral diagnosis more consideration. Our success will increase and dentistry will be placed upon a higher plane than ever before.

835 Lathrop Building.

DISCUSSION

Boyd S. Gardner, Rochester, Minn.: Oral diagnosis is defined as the art of distinguishing one disease from another, or the determination of the nature of disease in the oral cavity. Therefore, it is apparent that Dr. Westenhaver has not confined his paper to its title but has called attention to the importance of our knowing more about the general condition of our patients, a point that has been emphasized in the Section on Dentistry of The Mayo Clinic for many years. We appreciate that it is not always practical to have medical consultation, but, by the use of carefully taken histories, we can estimate, in large measure, the risk that must be taken in the extraction of teeth, and select the patients who should be hospitalized. Few dentists really practice oral surgery in its broad sense, but many who specialize in the extracting of teeth will take the responsibility of the management of benign tumors, fractures, etc. Undoubtedly, these specialists are better trained in oral pathology, but all dentists should be able to note abnormal conditions in the mouth. They should bear in mind that many systemic conditions show early oral symptoms, and if these were recognized, many patients would be benefited as they could be referred to competent physicians. Dr. Westenhaver has emphasized the necessity of more intelligent history taking so that physicians will have a better understanding of dental conditions when they receive a report. Physicians have justly criticized dentists in this respect and we quite agree that there is an opportunity for great improvement. The management of pulpless teeth grows easier as we obtain the cooperation of physicians and as we learn that the safety of such teeth is dependent on the general condition of the patient. Hence, the importance of frequent examinations by physicians of patients who have these questionable teeth. The roentgen-ray examination as a routine procedure in all mouths whether teeth are present or not, and the vitality test, continue to be the important factor in making dental examinations. I am sure that this paper will aid materially in impressing dentists with their responsibility.

Carl W. Waldron, Minneapolis, Minn: I wish to emphasize Dr. Westenhaver's closing remarks as to the importance of further study of this important subject, and also to emphasize his statement regarding the necessity of having accurate case records, records that are not only understood by the individual making the records, but also may be transferred to other dentists when necessary and can be accepted by them and found useful. Dr. Westenhaver has brought to our attention the importance of developing the power of observation of the practicing dentist. We know that most dentists, and most physicians, are deficient in this most necessary accomplishment. It should, however, be directed along well considered lines, with the dentist's field of activity and usefulness and the reasons for which patients seek his services in mind. Dr. Westenhaver outlines a fairly large portion of the field of medicine. He did not make himself clear as to how much inquiry is made concerning a history of the patient's past dental experiences, nor did he let us know how much of a dental examination is made before making his systemic examination. I feel that this point is very important. Patients usually consult a dentist for three reasons: (1) for dental treatment; (2) for a complete dental examination, to find or rule out a dental disease that may be a factor in a systemic condition that is caus-

ing them more or less discomfort (they, however, not being under the care of a physician), and (3) on advice of their physicians for one or two things: the diagnosis of dental conditions that might be factors in their systemic condition or, an obvious factor having been discovered, a more complete diagnosis and treatment thereof. Such patients, and I include all three groups, want expert dental diagnosis and treatment; and to maintain the continued confidence of the patient, the dentist must show that he is master of his field. The time necessary to cover the medical outline given here would, I am afraid, disturb the patient, and tend to weaken his confidence and cooperation. I am saying this advisedly because I understand that this is preliminary to the main dental treatment. If it is accomplished as time goes on, or as the dentist works on the patient, and he records things here and there, it is, of course, quite a different matter. The procedure of choice is first to find out the patient's present dental complaint and any outstanding systemic complaint, if present; to make a preliminary short survey of the teeth and investing tissues, and then inquire in detail regarding the past dental history, the trouble had with teeth restoration, etc., showing an interest in the patient that will impart confidence,

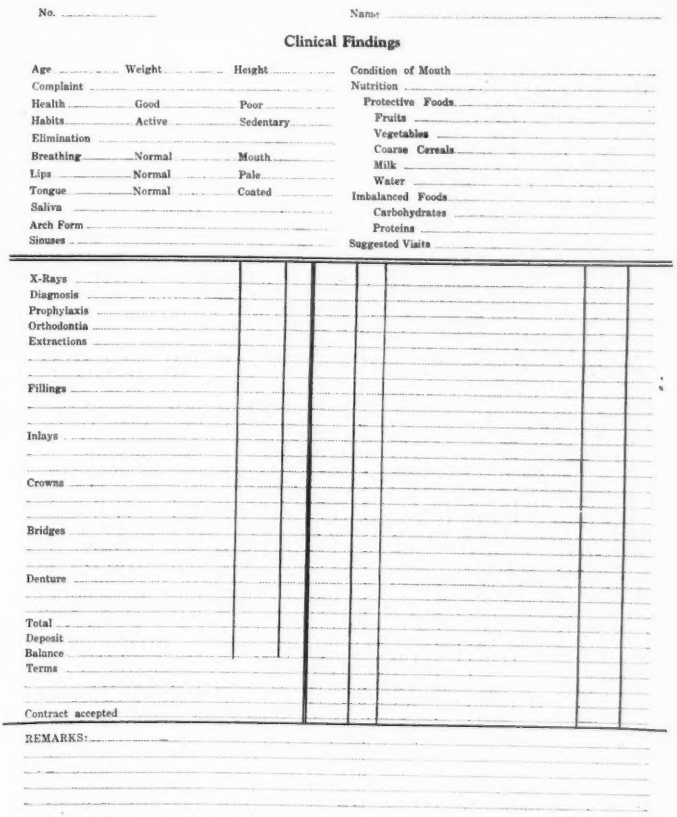


Fig. 1.—Clinical chart.

which is very desirable. In the case of the patients who come in for dental treatment, or for examination, knowing there is some systemic trouble but are not actually under the care of a physician, the preliminary examination and history outline should be followed by a brief systemic history. This may be accomplished in a matter of ten or fifteen minutes, being preceded by something in the way of an oral examination and dental history. Thus, the confidence of the patient is maintained and he realizes that here is a dentist the case history, determine the desirability of referring patients to a physician in a majority of cases, and can develop his judgment regarding the amount and type of surgical or restorative work to be performed, or whether dental work of all types should be postponed for a time. A small minority of cases will reveal little of importance on visual examination, or from the history, and only a complete medical examination may reveal the precarious condition of the patient. I want again to emphasize the importance of

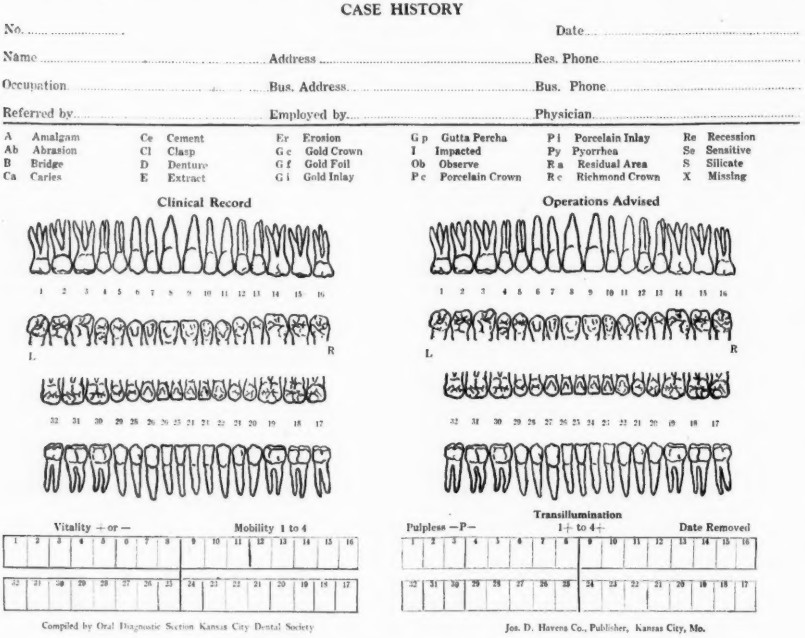


Fig. 2.—Reverse side of clinical chart.

who has not only an interest in tooth structures and investing tissues, but also in the relationship between the bodily health of the patient and the conditions of the mouth. In the other cases referred by the physician, I feel that most of you cooperate with the physicians of your district and have their friendship, and can possibly get a brief summary of findings and of the systemic history which will be ample. In this manner, the dentist may, by his visual observation and our field. One of the best ways to take our place as a scientific profession is to continue the research that is now going on. Here, in our meeting, we have ample evidence of the continued research and study of a great number of the members of the dental profession. Things are being discovered, new treatments will be elaborated on and perfected, and along with this our methods of diagnosis will be improved. I want to again emphasize what Dr. Westenhaver said with

reference to the power of observation, how it should be developed, and yet not allowed to take up too much time or divert the attention of the dentist from his special field. The dentist has his field in oral diagnosis, and many experienced men have gone before him. All of their experiences can be used and laboratory tests have their place, but when a man believes that he has to make a differential blood count to determine what he has to do in the mouth, we know that he is mistaken. The dental profession should assuredly appreciate the fact the the mouth, teeth and investing tissues are an integral part of the bodily system and may be reciprocally related to conditions and diseases of other parts of the body. It behooves the members of the profession, therefore, to learn as much as possible about these relationships. The first responsibility is to practice dentistry according to the higher standards of the profession and to master the field of the mouth in the fullest possible manner. In addition to this responsibility, there is another which I feel rests definitely upon the dental profession, and this is to be so trained that members may diagnose where possible, the oral manifestations of systemic diseases and may recognize certain surgical lesions of the neoplastic type in their early stages. In addition to these responsibilities, the dentist has certain opportunities in the matter of so training his powers of observation, of understanding and perhaps intuition, to enable him to refer certain of his patients to physicians early in the course of the systemic disease. This, as I said before, is an opportunity. It is not a responsibility, and it does not make necessary the visual diagnostic methods outlined by Dr. Westenhaver. In the hands of an expert, that is very desirable, but certain of the rank and file might be a little misled in some respects. Therefore, I wish to emphasize the mastery of the field of the dentist. It is a big field and a difficult field in connection with the oral cavity, the teeth and investing tissues, which will test the ability of any member of our profession, and excursions into the fields of other specialties of medicine are in bad taste and fraught with disaster.

Dr. Westenhaver (closing): Dr. Gardner said I did not confine my paper to the title. I am perfectly willing to stand corrected, and no doubt the title should have been "Oral Diagnosis and General Observations." Dr. Waldron asked in regard to the preliminary history. Do not understand me to say that it is necessary to go into such a complete history of all cases as I have outlined, but we can make many observations without asking the patient a question. As an example, a patient who has an occlusal cavity in a molar tooth may be in the early teens and apparently in good health. Such cases as these do not require such extensive charting as we have outlined here. If such a patient shows signs of ill health and decay is quite prevalent, we have a case which needs close attention and examination, together with a complete record, from our viewpoint. The necessity for such examinations and records must, of course, be left to the judgment of the operator. Dr. Waldron spoke of making patients nervous asking them questions. When a patient comes to us for an opinion or diagnosis, we should be guided by the type of the individual case. Such patients are already nervous and are seeking health advice, and it is simply up to us and our methods of handling patients as to whether we make them nervous. In regard to opportunities and responsibilities: True it is, we have a class of individuals who never assume a responsibility, but if we have the best interest of our patients at heart, if we are sincere as to their welfare, I am sure we will be big enough to assume these responsibilities, as far as we are justified, and we will consider the things that I have outlined a responsibility as well as an opportunity. You must remember the same blood which courses through the blood vessels of the tooth pulps, and the mucous membrane, which overlies the structures of the mouth, supplies other tissues as well. Therefore, we should be just as responsible for observations and for a check up of deviation from normal, as the man who is practicing rhinology or any other specialty in the line of medicine. We do not advise you to have a blood count made of every patient who comes to your office, but only for special cases. If you are going to carry out tooth extraction or surgical work on a patient whom you suspect has anemia, a blood count is necessary. We come in contact with but few cases such as these, but let us safeguard ourselves against misjudgment in that one case in a thousand.

ROOT RESORPTION AND ITS CLINICAL SIGNIFICANCE*

By JAMES L. ZEMSKY, D. D. S., New York City

A STUDY of a large amount of clinical material as well as of roentgenologic findings clearly indicates that there are several types of root resorption with which the clinician comes in contact in daily practice. Depending on the different conditions with which root resorption has been observed to associate, the handling of such cases naturally must differ. On the basis of clinical and roentgenographic studies, the different kinds of root resorption may be conveniently grouped under the following headings:

Group I. Deciduous teeth.
- (*a*) In the presence of the germs of permanent teeth.
- (*b*) In the absence of the germs of permanent teeth.

Group II. Pulp disturbances.
- (*a*) Granulomas.
- (*b*) Cystic degeneration.
- (*c*) Root-canal treatment.

Group III. Necrosis of the jaws following acute osteomyelitis.

Group IV. Replantation of teeth.

Group V. Root resection.

Group VI. Retained teeth.
- (*a*) Involvement of the retained tooth.
- (*b*) Involvement of the adjacent tooth.

Group VII. Trauma of various types.
- (*a*) Poor prosthetic restoration.
- (*b*) Malocclusion.
- (*c*) Orthodontic treatment.

Group VIII. Oral neoplasms.
- (*a*) Benign growths.
- (*b*) Malignant growths.

Group IX. Periodontal disturbances —"diffuse atrophy."

Just a glance at this classification will convince one that this subject is of great practical interest.

ROENTGENOLOGY

Since roentgenology is practically the only means of discovering resorbed roots prior to the removal of teeth so affected, a consideration of it seems to be a good starting point for such a discussion.

The roentgenograms herein presented have been selected as typical examples of conditions most frequently met in daily practice. All these roentgenograms are arranged in accordance with the classification given above, and thus each illustration is to be found in its respective group.

Group I. Resorption of Roots Associated with Deciduous Teeth. (a) In the Presence of the Germs of Permanent Teeth.—Figure 1 illustrates a condition normal in children and occasionally observed in adults also. The roots of the deciduous teeth are seen to be resorbed in the presence of the normally erupting permanent teeth.

*From the Research Department (Director, Balint Orban) of the Chicago College of Dental Surgery, Dental Department of Loyola University.

(b) In the Absence of the Germs of Permanent Teeth.—Figures 2-3 present another illustration of root resorption. Here, the resorption of the roots of the deciduous teeth has taken place in the absence of the germs of the permanent teeth.

Fig. 1.—Resorption of roots of both deciduous mandibular cuspids in the presence of normally erupting permanent teeth.

Figure 2 is from the upper jaw of a girl, aged 19, who noticed that the left lateral incisor was becoming loose. Both the roentgenographic and the clinical

Fig. 2.—Root resorption of the deciduous right maxillary lateral incisor. No sign of the permanent lateral is seen.

examinations revealed that the loose tooth was a deciduous tooth with its root completely resorbed. There was no sign of a permanent tooth in this region. The right lateral incisor had previously been lost and replaced by a bridge.

Figure 3 is from the lower jaw of a boy, aged 13, who presented an acute alveolar abscess caused by the presence of a badly broken-down mandibular first permanent molar. The roentgenogram reveals complete resorption of the

Fig. 3.—Complete resorption of the roots of the deciduous mandibular second molar. The bicuspid is absent.

roots of the deciduous second molar, which is seen to be wedged in between the adjoining first bicuspid and the first molar. There was no sign of any permanent tooth in this region; which indicates that the germ of the second bicuspid was absent.

Fig. 4.—Resorption of a root of the second mandibular bicuspid. The root canal is incompletely filled. The periapical area of rarefaction indicates the presence of a granuloma. This was ascertained after the removal of the tooth.

Group II. Root Resorption Observed in Connection with Pulp Disturbances. (a) Granulomas.—Figure 4 is from

the lower jaw of a woman, aged 29. It shows resorption of a root and the presence of a dental granuloma. Conditions of this nature are regarded as pathologic and are treated in various ways, some of the methods employed being root-canal therapy, root resection, replantation and extraction.

Fig. 5.—Cyst involving the left maxillary cuspid and lateral incisor. These show resorption of the roots at the apical third.

(b) Cystic Degeneration.—Figure 5 shows the teeth of a patient, aged 31, who, for some time, had noticed a recurrent swelling on the gum. There was no pain, but the picture revealed an area of cystic degeneration with resorption of the roots of the adjoining teeth. Cysts require surgical treatment.

Fig. 6.—Resorption of the root apex of the left first maxillary bicuspid. Only one canal is filled. The guttapercha is seen to be embedded in the bone that partly fills in the space originally occupied by the apex of this tooth.

(c) Root-Canal Treatment.—Figure 6 shows resorption of the root apex of the maxillary first bicuspid with the root-canal filling material extending into the tooth socket, which is not completely filled with bone. This roentgenogram was from the upper jaw of a woman, aged 38, who was suffering from severe arthritis deformans.

Fig. 7.—Radiolucent area in the apical region of the left mandibular lateral and both central incisors. The involved teeth show resorption of their root apices, which was due to necrosis.

Fig. 8.—Condition of the replanted right mandibular cuspid five months after this operation. (Compare Fig. 9.)

Group III. Root Resorption in Connection with Necrosis of the Jaws.—Figure 7 is from the lower jaw of a man, aged 38, who suffered from acute osteomyelitis and had a fistulous opening in the region of the apex of the left

mandibular central incisor. Such a case of root resorption demands extraction of the teeth involved and removal of sequestrums.

Group IV. Root Resorption in Connection with Replanted Teeth.—Various degrees of root resorption may be observed in Figures 8-13, which show replanted teeth.

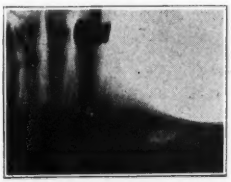


Fig. 9.—Resorption of the root of the replanted right mandibular cuspid which took place one year after the replantation. (Compare Fig. 8.)

Figure 8, from the lower jaw of a woman, aged 36, was taken about five months after the tooth had been replanted. The apical part of the canal was filled with a gold point, which had been burnished flush with the root surface. Figure 9 shows the case a year later. The gold point, which at the time of filling reached the end of the tooth, now extends beyond the apex; which indicates the amount of root resorption.

Fig. 10.—Left maxillary central incisor which was knocked out, filled and ready for replantation. (Compare Figs. 11 and 12.)

Another example of root resorption in a replanted tooth is shown in Figures 10-12. The bone surrounding the root of the replanted tooth has filled the socket. The patient was a boy, aged 14, who injured the tooth in an accident.

Still another case of root resorption in a patient, aged 37, is presented in Figure 13. This picture is quite similar to Figure 10, although here a multirooted tooth is seen.

Fig. 11.—Replanted left maxillary incisor as it appeared one month after the operation. (Compare Figs. 10 and 12.)

Group V. Root Resorption in Connection with Root Resection.—Figure 14 is from the upper jaw of a patient, aged 24, who had had the roots of both maxillary central incisors and of the right lateral incisor amputated about four years previously. It clearly shows

Fig. 12.—Complete resorption of the root of the replanted left maxillary incisor. (Compare Figs. 10 and 11.)

the root resorption of the lateral incisor.

Group VI. Root Resorption in Connection with Unerupted and Malposed (Retained) Teeth.—The roots of both the retained tooth and the tooth against which the retained tooth is impacted may show resorption.

Fig. 13.—Complete resorption of both roots of the right mandibular second molar. The root canal filling material is embedded in the regenerated bone structure filling the tooth socket.

(a) Involvement of the Retained Tooth.—Figure 15 shows the upper jaw of a woman, aged 34, who presented a swelling of the face and a discharge of

Fig. 14.—Resorption of the root of the right maxillary lateral incisor, the apex of which was amputated four years prior to the taking of the roentgenogram.

pus from the region of the maxillary central and lateral incisors. All her teeth had been removed about two weeks previously, and the swelling and flow of pus had developed at just about that time. The roentgenogram reveals resorption of the root of a retained tooth.

(b) Involvement of the Tooth Adjacent to a Retained Tooth.—Figure 16, from the lower jaw of a patient, aged 26, reveals resorption on the apical part

Fig. 15.—Resorption on the side of the root of an unerupted and malposed left maxillary cuspid.

of the root of the bicuspid close to the crown of a retained tooth. Both the retained tooth and the bicuspid against which the retained tooth was impacted

Fig. 16.—Resorption on the side of the root of the left mandibular cuspid against which a bicuspid is seen to be impacted.

were removed. Microscopic examination of the extracted first bicuspid confirmed the diagnosis of root resorption.

Group VII. Root Resorption in Connection with Trauma.—This kind

of root resorption may be found under different circumstances.

(a) Poor Prosthetic Restoration.—Figure 17 shows the upper jaw of a woman, aged 24, who had suffered a nervous breakdown. The prosthetic

Fig. 17.—Resorption of the apical portion of the left maxillary central incisor with the root canal filling material extending into surrounding bone, filling in completely the apical part of the tooth socket.

restoration as seen here (a stationary bridge carrying two pontics attached to *one* crown) caused the severe trauma,

Fig. 18—Resorption of the apical third of the root of the right maxillary lateral incisor. The root canal filling material projects into the tooth socket.

which probably caused the extensive resorption of the root.

(b) Malocclusion.—Figure 18 is from the upper jaw of a woman, aged 24, who complained of an uneasy feeling in the maxillary lateral incisor. Clinically, no sign of any abnormality or pathologic process could be found, but the roentgenographic examination revealed re-

Fig. 19.—Resorption of the apex of the right maxillary lateral incisor which followed orthodontic treatment.

sorption of the apex with its root-canal material projecting into the socket. The inlay shows strong evidence of traumatic occlusion, which very probably was the cause of this root resorption.

Fig. 20.—Resorption of the apex of the left maxillary lateral incisor following orthodontic treatment.

(c) Orthodontic Treatment.—Figures 19-20 illustrate a case of root resorption following orthodontic treatment. The patient, a girl, aged 18, had come

in three years previously for the correction of irregularities of the teeth. Both maxillary lateral incisors were in lingual occlusion. After the regulating appliances had been worn for a year and a half, the teeth were brought into perfect alinement. About a year later, the lateral incisors were found to have migrated somewhat toward their original positions. Clinically, the teeth were perfectly normal, and tests showed that the pulps were vital. The roentgenographic examination disclosed resorption of the root apices of both lateral incisors, which was probably due to a forced movement of the teeth by the orthodontic apparatus.

Group VIII. Root Resorption in Connection with Oral Neoplasms. (a) Benign Growths.—Since root resorption in connection with benign growths in the mouth is seldom observed, there are no roentgenograms available for presentation here.

(b) Malignant Growths.—Figure 21 was from the case of a boy, aged 19, who presented adenocarcinoma of the mandible. All the teeth involved show root resorption.

Figure 22 is from a case of a man, aged 56, who had an osteosarcoma of the right maxilla. The root of the molar shows resorption.

Group IX. Root Resorption Due to Periodontal Disturbances—"Diffuse Atrophy."—The series of roentgenograms Figures 23-36 reveal an entirely different kind of root resorption from that shown in Figures 1-22. This type of resorption, which so far has been studied very little, constitutes for the most part the material for the present investigation. The condition may be observed on roots of both vital and pulp-

Fig. 21.—Almost complete destruction of the mandible, with resorption of the roots of the left mandibular teeth due to the presence of the neoplasms.

less teeth. Such teeth may present perfectly sound crowns, as is seen in Figures 30-32 and 36. Their peculiarity may be noted in Figures 30-36. Here are seen either baylike excavations, as illustrated in Figures 30 and 35-36, or merely shortened roots with smooth and

Fig. 22.—Radiopaque area in the right maxilla and resorption of the roots of the molar, which is caused by a growth.

continuous surfaces, as seen in Figures 23-29.

The clinical pictures may differ, just as the roentgenographic pictures do, in

Fig. 23.—Resorption of the right maxillary central incisor. The crown of this tooth is perfectly sound.

appearance. For instance, the main characteristic of the cases shown in Figures 31-32 and 36 is complete absence of *any* clinical symptoms, and the case shown in Figure 30 presents a very definite clinical picture of an acute abscess. Briefly, the latter case may be described as follows:

The patient, a man, aged 28, experienced severe pain in the mandible and a

Fig. 24.—Resorption of the apical end of the right maxillary central and lateral incisors. The crowns are affected by caries.

marked swelling on the left side of the face. A palpable, fluctuating mass was found in the mucobuccal fold in the region of the left mandibular bicuspids. On percussion of these teeth, a slight

Fig. 25.—Almost complete resorption of all the roots of the left maxillary second molar. New bone is seen to fill the tooth socket.

tenderness was felt. The first bicuspid was found to be vital, normally responding to the various pulp vitality tests. However, while this case presents a different clinical picture, it may be of the same type of resorption as is shown

in Figures 23-36, and therefore may be considered as another variety of this class.

The diagnoses of these different conditions can be made solely from roentgenographic examinations. Great care

Fig. 26.—Resorption of the apical half of the root of the left mandibular lateral incisor.

should be exercised to avoid errors, which would naturally lead to improper handling of the cases, permitting some pathologic condition to exist or unnecessarily sacrificing healthy structures. This brings up the consideration of clinical findings and the histopathology of root resorption.

Fig. 27.—Resorption of the second right mandibular bicuspid leaving a perfectly smooth root surface. The crown of the tooth is perfectly sound.

After a survey of the roentgenograms herein presented, we may conclude that all the conditions revealed by these roentgenograms are pathologic, requiring treatment. Some of these cases may be effectively treated by means of root-canal filling; others will require surgical

Fig. 28.—Resorption of the root of the first mandibular bicuspid. The crown of this tooth is carious.

operations, whether mere extraction, root resection or extensive curetting of the areas involved. Just what method of treatment the operator will choose depends on his previous experience and the

Fig. 29.—Resorption of the apical third of the root of the second mandibular bicuspid.

success which he has met in handling such cases.

In this paper, interest is focused especially on the cases described under Group IX. As a rule, these cases are discovered accidentally through routine roentgen-

ographic examination of the mouth. In following the general practice of removing teeth affected by root resorption, an opportunity was presented to secure material for study. So far, two cases have been studied, with the results herein

Fig. 30.—Lacunar resorption on the side of the root of the first mandibular bicuspid.

presented. While the investigation cannot by any means be considered as completed, the practical conclusion to which it leads is clearly defined.

HISTOPATHOLOGY

CASE 1.—The photomicrographs reproduced in Figures 37-41 were taken of

Fig. 31.—Resorption of the apical half of the root of the right maxillary central incisor. The tooth has a sound crown.

serial sections prepared from specimens secured by extraction of the two maxillary central incisors of a woman, aged 24, who, for five years, had been suffering from neuralgic pain affecting the left side of the face. According to her statement, the physicians who had treated her made an exhaustive study of the case without either finding the cause of the trouble or giving her any relief. She

Fig. 32.—Resorption of the apical half of the root of the left maxillary central incisor and the apex of the root of the left lateral incisor. The teeth affected have sound crowns.

then decided to determine whether her teeth had anything to do with her general condition, and for that purpose had roentgenograms made of her mouth.

Fig. 33.—Resorption of the apex of the root of the left maxillary lateral incisor.

Among the roentgenograms, Figures 31-32 show extensive resorption of the apical half of the roots of the two maxillary incisors and of the apex of the left lateral incisor. *This was the only evidence* of the abnormality of the teeth,

for clinical examination failed to reveal any such indication. The teeth were firm, the appearance of the crowns was absolutely normal and the occlusion was good. Response to both electric and

Fig. 34.—Resorption of the apical half of the root of the right maxillary central incisor.

thermal pulp vitality tests was similar to that of the healthy teeth. Therefore, the only evidence of the abnormality, as already stated, was the roentgenographic finding.

Fig. 35.—Baylike excavation at the side of the apical portion of the root of the left maxillary central incisor. The lateral incisor with an incompletely filled root canal presents a periapical radiolucent area.

The patient was told of the existing condition and advised that the only means for its correction was the removal of the teeth. It was further explained to her that, while her general health might not be improved as the result of such a procedure, their removal was advisable in view of the fact that all previous attempts to give her relief had completely failed.

Realizing the situation, she agreed to the removal of the two maxillary central incisors. Extraction of these abnormal appearing teeth had no appreciable effect on her general condition. She was observed for a period of more than two years, and no improvement was noted. The operation was of importance, for valuable material was secured which was used for the purpose of studying this condition.

Fig. 36.—Complete resorption of the root of the left maxillary central incisor and a baylike excavation at the middle of the root of the right maxillary central incisor.

The photomicrographs Figures 37-39 were taken from the histologic slides prepared from the removed right maxillary central incisor. Since the tooth was not sectioned centrally through its long axis, the apical foramen is not shown. Other sections in the series show the foramen. As the apical half of the root had been resorbed, it could not be shown on the specimen. Consequently, the tooth looks as if its roots had been fractured during extraction. The pulp as seen at *a,* Figure 37 is quite normal,

Fig. 37 (Case 1).—Right maxillary central incisor. *a*, pulp, normal, no sign of any inflammatory or degenerative changes. *b*, dentin. *c*, cementum on the sides of root. *d*, line of resorption. The whole apical half of the root is resorbed. *e*, small area of resorption on the side of the root. *f*, deep baylike resorption in the root.

and there are no signs of any inflammation or any other degenerative changes.

In the part of the pulp near the apex, as shown in Figure 38, a few calcified bodies *(g)*, so-called *denticles*, are clearly shown. In this specimen is seen some bleeding in the pulp tissue *(d* and *e)*, which undoubtedly is due to the tearing of blood vessels during the extraction of the tooth. The wall of the pulp chamber is lined with normal odontoblasts *(f)*, and the layer of uncalcified dentin shows that this new dentin was built just previous to the extraction. The odontoblastic layer can be traced directly to the apical foramen of the tooth. (Fig. 38, *h*.)

In Figure 37, *f* points to a baylike concavity invading the dentin, while *e* shows a small resorption lacuna on the side of the root.

Figure 39 shows a higher magnification of the area *f* in Figure 37. A deep resorption is seen in the dentin *(a)*, but the line of resorption *(e)* is not limited by resorbing connective tissue. Instead, a bonelike substance *(c)* is deposited on the surface of the resorbed dentin. The connective tissue *(d)* in the resorbed baylike concavity is fibrous in nature and, in some places, shows hemorrhages *(f)*, which it is reasonable to believe were caused by the extraction.

Figure 40 shows a section through the left maxillary central incisor. The appearance of the pulp *(h)* is identical with that of the right maxillary central incisor. Because the section reproduced in this illustration is an oblique cut, it does not show the entire pulp canal and the apical foramen. In the series of sections, the pulp canal may be traced to the foramen, and nowhere can any pathologic changes be observed. Outside the pulp canal, normal connective tissue is found, the appearance of which is characteristic of a normal periodontal membrane.

Above the pulp tissue, as shown in Figure 40, a round area *(c-e)* is observed. This is due to resorption of dentin. In the center of this area, bone *(e)* is seen, which is surrounded by fibrous connective tissue like that of the periodontal membrane. This connective tissue separates the bone from the wall of the cavity, which is lined with a thin layer of cementum *(c)*.

A higher magnification of the round area *(c, e)* shown in Figure 40, prepared from one of the neighboring sections of the series, is shown in Figure 41. In this picture, the cavity is seen to open toward the side of the tooth and into the periodontal membrane *(h)*. This points definitely to the fact that the resorption which had taken place some time ago on the surface of the tooth progressed, excavating the dentin until the cavity formed. At the time of the extraction of the tooth, there was no active resorption, as is seen by the fact that the wall of the cavity is lined with a layer of cementum *(c)*, the space being filled with connective tissue and bone *(e)*, which was produced by it. Both the cementum *(c)* and the bone *(e)* could be formed only after resorption had been arrested. The cementum is seen not only in the cavity but also upon the surface of the resorbed end of the root, as shown in Figures 40-41 at *d*. Opposite this newly formed cementum, there is new bone *(f)*, which is separated from the surface of the cementum by periodontal membrane *(g)*.

Attention is here called to the fact that, normally, neither bone nor periodontal membrane could be found in this area, which is naturally occupied by the root when it has its normal anatomic form. Consequently, bone *(f)* could

Fig. 38.—Tooth shown in Fig. 37; another section of the series. The "apical" foramen is to be seen at *h*. *a*, pulp. *b*, dentin. *c*, newly deposited cementum on the resorbed surface. *d*, bleeding in the pulp due to the extraction. *e*, bleeding along the odontoblasts. *f*, odontoblasts, which may be traced toward the "apical" foramen. *g*, denticles.

not occupy this space unless a part of the root was resorbed. The root, therefore, was resorbed first, bone developing only after that.

The deposition of the cementum on the surface of the resorbed dentin shows that the condition which led to the resorption had been eliminated, and that a natural repair had taken place.

In studying this natural repair, it can be observed that it has resulted in a development of normal periodontal membrane and alveolar bone. Hence, the functional relationship between the tooth and the surrounding structures has been reestablished, the cementum, periodontal membrane and alveolar bone being formed.[1]

The higher magnification of the resorbed area presented in Figure 41 clearly shows both the newly built cementum on the surface of the dentin *(c)*, and new bone trabeculae, which fill the space *e*.

Before discussing the significance of the facts described above, a consideration of another case studied in this connection will be presented.

CASE 2.—A man, aged 42, who suffered from sciatica, was referred by his physician for a mouth examination, which led to a diagnosis of suppurative periodontitis confined to the region of all the posterior teeth. The series of roentgenograms which were taken, besides showing extensive alveolar resorption involving all the posterior maxillary and mandibular teeth, revealed resorption of both maxillary central incisors, as shown in Figure 36. Clinical examination of the maxillary central incisors disclosed the fact that the teeth were sound, firm, normal in color and shape, and in perfect alinement. Vitality tests revealed that the pulps were nonvital.

Because of the patient's physical condition, it was decided that all the teeth showing advanced pyorrhea should be extracted, as well as the nonvital teeth. Hence, the two central incisors were removed. On examination, a slight, rough protuberance was noticed on the extracted left central incisor approximately in the middle of the root on the mesial aspect. By means of an excavator, this protuberance was easily lifted out of its seat in the root. It was a hard bonelike structure, fitting well into the cavity of the root. (*A*, Fig. 42). After the specimen had been decalcified, serial sections were made and photomicrographs taken. (Figs. 43-46.)

A study of the histologic slides reproduced in these illustrations clearly explains the reason for the failure of the teeth to respond to the pulp vitality tests. The photomicrograph of the right central incisor shown in Figure 43, which was taken at a low power, discloses that the pulp chamber normally occupied by pulp tissue is filled with a bonelike substance *(b)*. This bonelike substance does not present the absolute characteristics of bone structure. It has no typical bone corpuscles, nor does it show the lamellated arrangement. In the center are seen large spaces, indicating the course of blood vessels. In the middle of the root *(a)*, a cavity is noticed, due to the resorption that is shown in the roentgenogram. A higher magnification of area *b*, Figure 43, is shown in Figure 44. This shows the pulp chamber filled with the peculiar, bonelike structure. No sign of any resorption can be seen on the borderline between the dentin *(a)* and this bonelike structure *(b)*. The entire picture gives the impression that the

1. For a more thorough discussion of these problems, see Orban, B.: Dental Histology and Embryology, Chicago: Rogers Printing Co., 1928.

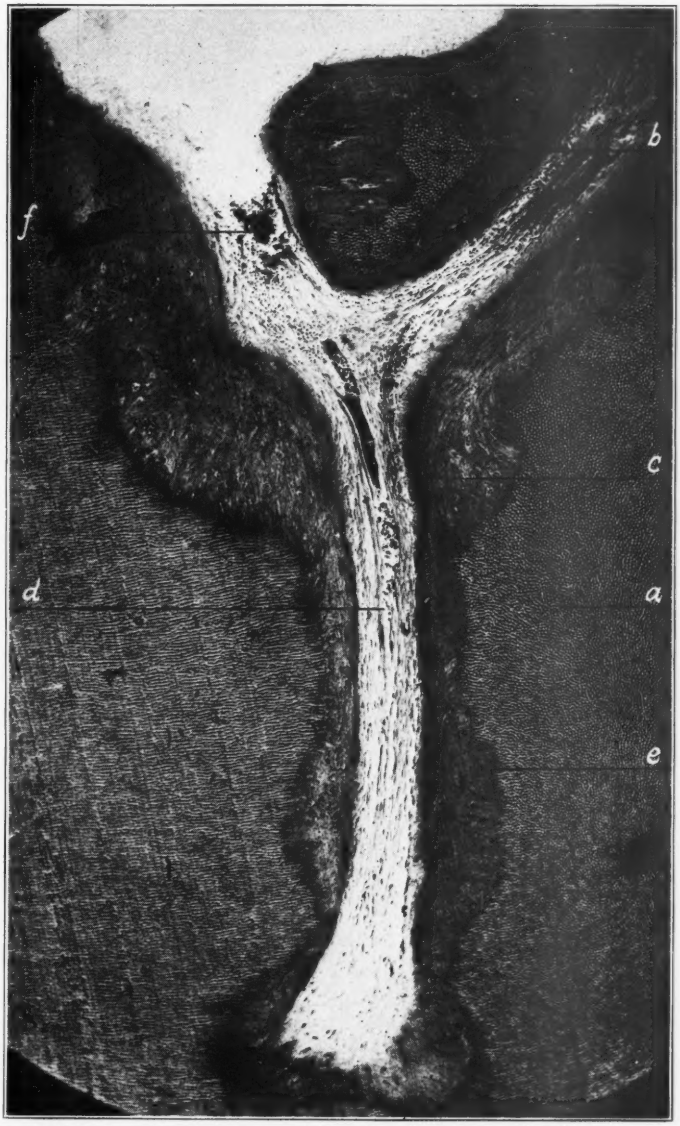


Fig. 39.—Higher magnification of area *f*, Fig. 38. There is deep baylike resorption in the dentin. The resorption surface (*e*) of the dentin (*a*) shows lacunae and is covered by a bonelike substance (*c*). In the baylike deepening is observed a fibrous connective tissue (*d*) with bleeding at some places (*f*). This is probably due to the extraction. *b*, an island of dentin surrounded by the bonelike substance, which has been deposited after the resorption ceased.

whole pulp tissue has become completely calcified.

This bonelike substance may be looked on as a type of secondary dentin or as a product of pulp metaplasia. The case may be compared with the one presented by H. Euler[2] and described by him as metaplasia of the pulp. The comparison is based upon the study of the photographs of the histologic specimens only, and the structure appears to be similar to that found in Euler's case. Besides this comparison, nothing definite can be said regarding its origin.

Figure 45 reveals the fact that this bonelike substance also presents signs of resorption *(e)*, together with the dentin. This suggests that this formation had begun before the resorption of the wall of the dentin had commenced; which may indicate that the particular substance seen here is a product not of periodontal connective tissue but of the pulp.

At *f*, Figure 45, we see bone trabeculae which remained attached to the tooth surface after the larger part of this bone was removed by an excavator after the extraction. The deposition of this bone within the resorption lacunae may indicate that the cause of the resorption, as in Case 1, had, at this time, been eliminated, and repair had already taken place.

The apical portion of the same tooth is shown in Figure 46. The substance filling the apical portion of the canal *(c)* resembles real bone structure more than that in the coronal portion of the tooth. It is obvious that the dentinal wall *(d)* was resorbed before the bone was laid down. This indicates that it is the periapical connective tissue that is responsible for the production of this bone structure. The side canal *(e)* also shows former resorption and its subsequent filling in by bone structure.

2. Euler, H.: Metaplasia of the Pulp, Vierteljahrsschr. f. Zahnheilk., Vol. 3, 1921.

CONCLUSIONS

As was stated at the beginning of this paper, it is not the aim of this study to enter into a profound discussion of the etiology of root resorption. Some types of root resorption as shown in Figures 1-22 seem to be of definite etiology; but such types are not included in this discussion. Present interest is concentrated on those cases of root resorption which are of vague and unknown etiology, such as, for instance, Cases 1 and 2, herein reported, and shown in Figures 22-36.

It seems advisable to call attention at this point to Gottlieb's work[3] in which he considers one particular type of root resorption that appears to simulate the two cases described here. He speaks of a type of root resorption in which the resorption is but a *symptom* of a disease which he calls diffuse atrophy. According to his explanation, diffuse atrophy is clinically characterized by wandering and loosening of the teeth, either singly or in groups. Microscopically, he has found resorption on the surfaces of the roots as well as on the alveolar bone, accompanied by development of granulation tissue. He states that this process may be arrested temporarily or even permanently. When this occurs, microscopic evidence is seen in a new development of cementum, which fills in the resorbed surfaces. Building of a new alveolar bone also takes place at this time. So far, little is certain as to the cause of this disease.

Recently, J. Weinmann,[4] a preceptor of Gottlieb, found that, in cases of

3. Gottlieb, Bernhard: Diffuse Atrophy, Ztschr. f. Stomatol., 55:195, 1923.

4. Weinmann, J.: The Circulation in Diffuse Atrophy of the Alveolar Process, Ztschr. f. Stomatol., No. 8, 1927.

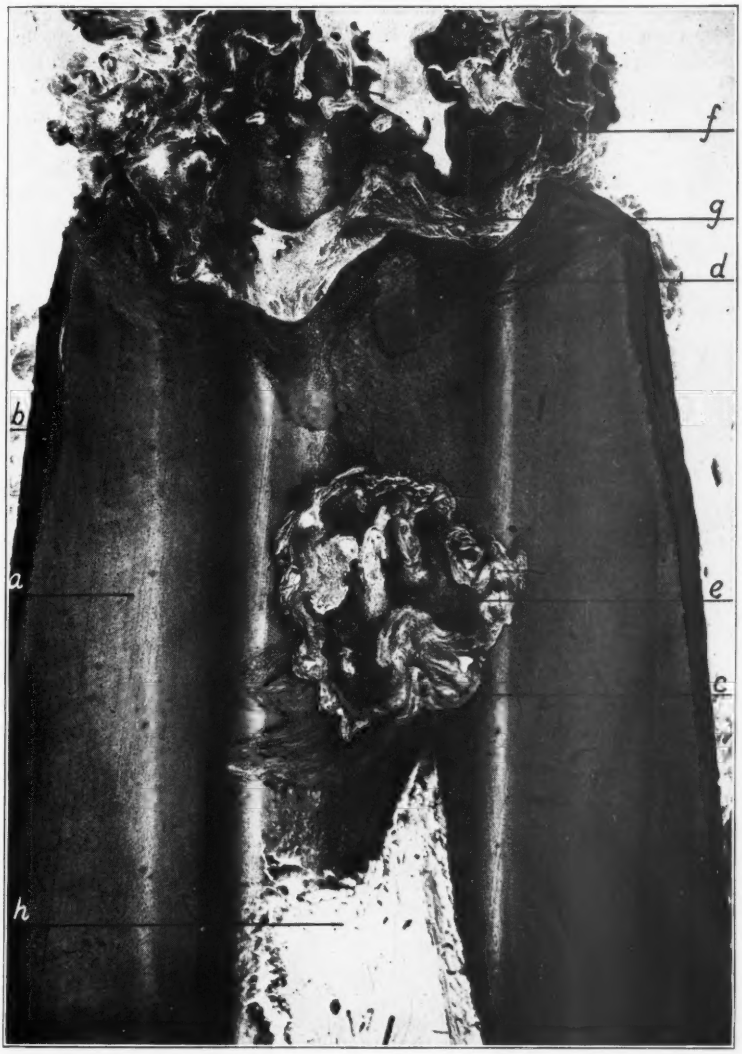


Fig. 40 (Case 1).—Left maxillary incisor. *a*, dentin. *b*, cementum on the side of the root. *c*, resorption area in the dentin lined with thin cementum. *d*, cementum deposited on the resorbed end of the root. *e*, bone deposited within the resorbed dentin. *f*, bone deposited opposite the new cementum at the end of the root. Formerly, this place has been occupied by the apical portion of the root. *g*, new periodontal membrane at the end of root. *h*, normal pulp.

diffuse atrophy, a typical metabolic disturbance takes place. The basal metabolism is normal, but the specific reaction to protein is low. Metabolism in normal individuals increases between 20 and 40 per cent after a protein meal; while, in persons with diffuse atrophy, the metabolic rate increases less than 20 per cent. According to Weinmann, this metabolic disturbance takes place with such regularity in persons affected with this lesion that it makes the test a dependable diagnostic means. For the purpose of definitely determining those cases which, it is suspected, present diffuse atrophy, but in which the clinical picture is not quite certain, Weinmann's metabolic test is very valuable.

The patients whose case reports have been presented in this paper were not subjected to this metabolic examination for the simple reason that, at the time they were undergoing examination, this relationship was not known, since Weinmann's report of his discovery appeared at a later date. Therefore, no data on this phase of examination are available in connection with the present report. Attention is called to this fact because it has such a direct bearing on our subject, and it is possible that these interesting findings of Gottlieb and those recently made by Weinmann may lead some investigators to further study, which may lead to some practical knowledge that can be utilized in the treatment of cases of diffuse atrophy.

The type of root resorption presented in the two cases reported is probably a *symptom* of diffuse atrophy. It is also possible that there is a special type of this disease of which the chief symptom is root resorption. This may occur prior to the wandering of the tooth and entirely independently of it. Another possibility is that, during active resorption, the tooth so affected becomes loose, and as soon as repair takes place, it tightens again; as probably happened in the cases reported herein. If all theorizing and speculation regarding the etiology of this resorption are left out, one thing is quite clear; and that is, that while the microscopic examination of the resorbed teeth removed in the cases just studied gives no clue as to the possible cause of the resorption, it offers very valuable information as far as it furnishes the clinician with a quite definite practical guide as to how such cases should be handled.

A study of the photomicrographs of Case 1 indicates that when the extraction was made, the destructive process producing the resorption had been completely arrested; for, otherwise, no repair characterized by the deposition of new cementum and bone could possibly have taken place.

The lesson to be learned from the study of this case is that the extraction of teeth showing root resorption on the roentgenogram and presenting no other evidence of a pathologic process or abnormality is not warranted. It has already been pointed out that when the extractions were made, the damaged tissues had been perfectly repaired by Nature's process, and, consequently, in the light of this definitely established fact, a sacrifice of teeth appears absolutely wrong and entirely unjustifiable.

The experience gained from the study of this report emphasizes the necessity of seriously investigating every case individually before reaching a decision to sacrifice teeth. The reason for any such sacrifice must be very definitely established. For example, a roentgenogram revealing resorption on the side of a root of a vital tooth and showing an area of rarefaction by no means affords

Fig. 41.—Case shown in Figure 40; another section of the series. The area of resorption in the dentin (*c-e*, Fig. 40) communicates with the periodontal membrane *h*. *a*, dentin. *b*, cementum at the side of the root. *c*, cementum lining the area of resorption in the dentin. *d*, cementum covering the resorbed end of the root. *e*, new bone deposited in the area of resorption in the dentin. *f*, new bone built opposite the root end. *g*, new periodontal membrane at the "apical" end of the root. *h*, periodontal membrane.

a sufficient reason for extraction. It is possible that, just at the time when the roentgenogram is taken, an active process of resorption is going on. This is true even when the cause for such resorption cannot be definitely established; which is very likely in view of the fact that the etiology of certain types of root resorption is very vague.

The only logical procedure to follow in handling such cases is to observe them carefully. After a few weeks or months, the cause may be eliminated and the damage repaired, just as in the cases here shown and demonstrated by the photomicrographs.

On the other hand, cases presenting root resorption which may be accounted for as caused by root infection, presence

Fig. 42 (Case 2).—Extracted right maxillary central incisor and the bonelike substance (*A*) which was removed from its surface with an excavator.

of neoplasms, etc., will obviously require an entirely different therapeutic procedure, aiming at the elimination of the exciting cause rather than the treatment of symptoms. Extraction of a tooth showing root resorption would be decidedly faulty, because the operator would be seeking to eliminate the symptoms rather than to cure the disease.

True enough, there are numerous diseases which medical science cannot fully explain, and which therefore are treated empirically. The best illustration of this is seen in neoplasms. But this is no reason for treating other cases

Fig. 43.—Low power photomicrograph of the right maxillary central incisor. *b*, pulp chamber filled with a bonelike substance. *a*, area of resorption. *c*, apical end of the root.

Fig. 44.—Higher magnification of area *b*, Fig. 43. *a*, dentin. *b*, bonelike substance filling the entire pulp chamber. The wall of the dentin is resorbed. *c*, large spaces occupied by blood vessels.

in a haphazard fashion. An earnest and serious attempt should always be made to determine the etiology, and, after the causative factor has been discovered, to exert every effort for its elimination. The extraction of a tooth showing root resorption *without* eliminating the cause may be favorably compared to the administration of acetyl salicylic acid (aspirin) to a patient suffering from acute maxillary sinusitis—unquestionably, a wrong and unjustifiable method of treatment.

It is quite apparent, then, that cases of root resorption that are not due to any known conditions are merely symptoms of some unknown disease, and that treatment of these conditions simply by extraction is nothing more or less than the equivalent of the administration of aspirin as just mentioned. All that can be accomplished by the extraction of such teeth is an elimination of *a* symptom resulting from some unknown cause, which still remains actively operating; and hence no cure can be effected.

Gottlieb, for instance, points out that one of the symptoms of diffuse atrophy is resorption of roots, and Weinmann shows that, in cases of diffuse atrophy, a metabolic disturbance is present. It is quite obvious, therefore, that, in this disease, extraction of a tooth with resorbed roots cannot change nor improve the existing metabolic disturbance. It is quite plain that the problem faced in a case of diffuse atrophy is to correct this metabolic disturbance. Whatever else may be done is merely a treatment of symptoms.

An important point brought out in Gottlieb's paper in connection with these conditions is that diffuse atrophy may be cured of its own accord, and that, when this occurs, the tissues that were damaged during the active destruction process undergo repair. This proves that the cause, unknown as it is, has been eliminated, and the exciting forces have ceased to operate.

An analysis of the findings reported in Case 2 leads to a similar conclusion; namely, that extraction of teeth showing resorption is not warranted, even if they do not respond to vitality tests. The facts that (1) new formation of bone took place, (2) there was no sign of inflammation and (3) new periodontal membrane was developed serve as conclusive proof of Nature's ability to cope with such conditions; and therefore any surgical interference is unquestionably contraindicated.

The outstanding feature which makes Case 2 different from Case 1 is the fact that teeth showing resorption were found clinically not to respond to the pulp vitality test. If teeth are pulpless, there may be an argument for their removal, as retention of pulpless teeth is often regarded as dangerous. However, it is easy to refute such an argument, for, in the first place, the structure showed absolutely no sign of inflammation; and, secondly, the whole pulp tissue was completely calcified. Under such conditions, the teeth cannot be looked on as possible foci of infection; consequently, it would be a fallacy to speak of such teeth as endangering the health of a patient.

To avoid possible misunderstanding, it may be advisable to mention here that unquestionably there are certain cases of root resorption in which the cause is to be found within the teeth themselves. By this, it is not meant to direct attention to cases of pulp infection, because, in such cases, the infection is the cause. The cases which deserve our consideration in this connection are those in which there seems to be some kind of change either in the cementum itself or

Fig. 45.—Higher magnification of the coronal portion of the tooth in Case 2. *a*, dentin. *b*, bonelike substance filling the entire pulp chamber. *c*, spaces for blood vessels. *d*, line of demarcation between dentin and the bonelike substance. *e*, resorption involving the bonelike substance of the pulp chamber. *f*, new bone within the resorption lacuna.

Fig. 46.—Apical portion of the tooth in Case 2. This is a higher magnification of portion *c*, Figure 43. *a*, dentin. *b*, cementum. The bonelike substance *c* resembles more true bone structure than that found in the coronal portion. (Compare *b*, Figs. 43, 44 and 45.) *d*, borderline between dentin and this bonelike substance. This line of demarcation indicates that resorption took place before the deposition of the bone.

in the whole tooth structure. Typical examples of these cases are seen in the root resorption of deciduous teeth when they are not replaced by permanent ones.

Here again, it must be stated that nothing is known regarding the resorption of the roots of the teeth such as is shown in Figures 2-3; nor is it intended to enter on a deep discussion of this matter here. It only seems that there is some kind of senility of the *tooth substance;* and this may probably serve as an explanation for this type of resorption, which, according to Gottlieb, is due to loss of vitality of the cementum. As far as the clinician is concerned, this type of case presents little difficulty. Such teeth do not have to be removed, regardless of whether they are deciduous or permanent. Only when such teeth become very loose and annoy the patient is extraction indicated.

SUMMARY

A tooth need not be extracted simply because of the resorption of its root. This holds true of both vital and pulpless teeth.

Root resorption is mostly a *symptom* of a disease and is not a cause.

An attempt must be made to determine the cause of root resorption, and, when this is discovered, to remove it if possible.

Every case of root resorption must be considered individually. This requires observation over a considerable period, during which time, notice should be taken of the changes that occur. Is there any sign indicating that repair is taking place, or is the condition growing worse?

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Editorials

THE MIDWINTER MEETINGS

In December, the First District Dental Society of New York held its annual clinic, and it was a most successful meeting in every way. There was a good attendance and the interest throughout was well sustained. A notable action taken at this meeting was the passage of a resolution deprecating misleading advertising on the part of those having for sale mouth washes or tooth pastes to be offered to the profession or the public. So many extravagant claims have been made for some of these products that the society thought that it was high time some action should be taken by organized dentistry to inhibit this practice. Now that the First District Society has taken the initiative, it is hoped that other organizations will take similar action. There should always exist between the manufacturers and the profession the most cordial relations, and there is no intent on the part of dental societies to reflect in any

way on reliable and conservative business concerns; but the profession can no longer assume that it is fulfilling its obligation to the people if it stands idly by and permits misleading advertising to be broadcast to the public. This one action of the First District Society will stamp the recent meeting—aside from its success in other particulars—as an outstanding event, and we hereby congratulate our New York colleagues.

The Midwinter Clinic of the Chicago Dental Society in January outstripped all of its previous efforts. According to the secretary's report it drew an attendance of about 7,000, which is a very wonderful record for a local society to make. The meeting was housed in the Stevens Hotel, the largest hotel in the world, which provided ample facilities for all of the sections as well as for the numerous clinics. The interest was keen throughout, and it was the consensus of opinion that much good was accomplished.

It is not so very many years ago that such meetings as that of the First District Society of New York and of the Chicago Dental Society would have been impossible on the part of a local dental organization. It would have been out of the question to get together such large numbers to attend the meeting of any local society, but these annual gatherings have been made so attractive that men find it advantageous to come from coast to coast, and the attendance is being swelled year after year.

And then these big events tell another story—they tell the story of an increasing interest in dental societies on the part of the profession. There never was a time in the history of dentistry when there was so much alertness as there is today. It no longer seems difficult to attract a large attendance at a meeting provided questions of interest are to be discussed. The profession is becoming more alive to the advantages of dental society effort than ever before, and there is a growing tendency for men to get together and discuss the professional problems that are of mutual interest. This is all to the good as far as progress is concerned, and thus the meetings just held may be taken as an encouraging indication of the present trend of the times. We congratulate the officers of these two organizations on their outstanding efforts.

IT DOESN'T MATTER

The real lessons of life seem so difficult to learn. Every day of our existence, we magnify the small things, the petty annoyances, the really insignificant distractions and perplexities that are a part of our common experience. Every small untoward occurrence that assails us leaves us dejected and unhappy. A thing that in a year from now or even in a month will look trivial and inconsequential, today looms up as a disaster. We find it so difficult to properly estimate the essentials, and we are forever distorting the significance of events.

Some one makes a derogatory remark about us and it is quoted to us—usually with exaggeration. Instantly, we are hurt and grieved, and usually we are angry, forgetting on the one hand that the remark or its intent was misrepresented to us and was not at all as reported, and on the other hand that even if it were, the possibility of harm being done us by the remark is infinitesimal. There are so many idle remarks circulating all the while that it is folly to pay any attention to them. They injure us only as we permit them to disturb our peace of mind.

There is so much in our daily lives and in our intercourse with men that is not fundamental, so much that really does not touch the mainsprings of our existence; and yet we go on wasting our energy in fruitless attempts to unravel the small tangled threads of circumstance and chance which go to make up the routine of our existence. Most of it doesn't matter, and even if it did, there is such a large percentage of it impossible of remedy that it is folly to fuss over it. If a thing cannot be prevented or remedied, there is nothing to be gained by fuming or lamenting about it. The sanest philosophy of life is to do the best you can, and let it go at that.

The really big men in the world are able to look a fact in the face and estimate it at its true value, and many times a day they find it necessary to say, "It doesn't matter." If they did not do this, they would waste much of their time in the inconsequential and unimportant, just as most of us do. As La Rochefoucauld has said:

"Little minds are too much hurt by little things. Great minds perceive them all, and are not touched by them." Isn't it sensible to try to be big enough to overlook the little things and concentrate on the things worth while? It seems that we have just so much energy to spend and no more—why not use it to the best advantage? Why not husband it by ignoring the trivialities and saving ourselves for the great issues of life?

We seem to be constantly putting a premium on the nonessentials. When a situation faces us that impresses us as important, let us stop and consider. Let us see if, after all, it is as vital as we had thought. Let us try to estimate it as it will look a year hence. In any event, let us face it as if it didn't matter. When we are confronted with a complicated problem and our responsibility seems burdensome, let us compare our situation with that of some of the great men of the world and see how insignificant our small affairs appear. Let us try to visualize the situation of Lincoln when the responsibility of saving a nation rested on his shoulders and all the agencies of evil were pitted against him; when men who should have been his most loyal supporters became his most bitter antagonists, and used every strategy to thwart him in all his constructive efforts; when the nation's salvation hung in the balance and every agency of destruction seemed in the ascendency, and he was charged with being the cause; when this great country was rent in twain and the furies were apparently let loose to bring about its disintegration and downfall; when the land that today blossoms with peace and plenty from one end to the other was being drenched in the blood of its best sons—when all of this was going on and Lincoln was the central figure with the chief burden bearing him down, what would have happened if he had permitted the trivial things of life to occupy his mind and divert him from his one supreme purpose of saving the Nation?

Compared with the responsibility of men like Lincoln, Washington and the other great national leaders, our small affairs sink into insignificance, and as everything in this world is relative, we may gain comfort and complacency by recalling what difficulties

others have surmounted, and how really unimportant are our own when considered in the same relation.

The great trouble with most of humanity is its narrowness of vision. We are all too prone to consider our affairs as among the most important in the world, when, as a matter of fact, the great majority of us could drop out of the picture tomorrow and the current of the universe would never be rippled. Let us estimate ourselves at our true worth, and we shall soon be brought face to face with the patent fact that even we ourselves are not so very important in the immense scheme of life, and that most of the things that we are inclined to consider of great moment do not after all matter so very much.

CHANGING FORMULAS

The art and science of rational therapeutics rests essentially on three factors: accurate and scientific diagnosis; a careful choice of drugs and medicaments accurately dosed, and interpretation of therapeutic effects in terms of the accurately administered dosage. This implies that the prescriber, be he dentist or physician, should know the qualitative and quantitative composition, as far as possible, of every medicament introduced into the body for a desired effect. These things he must know and practice if he would not be remiss in his duty to the patient and to himself. Dentistry finds itself in the position of being a party to the use of drugs the composition of which is undeclared or not readily available to the practitioner. As bad as such a situation is for the large number of the profession who wish to practice rational dentistry, it is overshadowed by formulas secret in nature and, self-confessedly, ever-changing.

Unfortunately, there are some manufacturers of dentifrices and dental medicaments who practice the utmost secrecy in the matter of their formulas and who expect the profession to sit idly by when the announcement is made in advertising pages that a formula is everlastingly changing to meet the thought of the profession. It is desirable that medicaments (including dentifrices)

be tried in the crucible of experience and changed to meet scientifically established dental thought, but not at the expense of rational therapeutics. Those members of the profession interested in rational dentistry have a right to question and ask, "What was and what is the formula?" If those manufacturers who use "changing formulas" as bait for sales do not at the same time furnish the profession with the old and new qualitative and quantitative formulas, they cannot and should not expect the profession to take their advertising talk seriously. At the same time, the profession may well look askance at the reputed therapeutic claims of these preparations unless they are backed by sound clinical evidence from reputed practitioners, published in dental journals of the highest standing.

The day of secrecy and irrationality in all phases of materia dentica is a thing of the past. The rank and file of the profession are now in the mood to say, "Lay your cards on the table. Then we will be in a position to judge whether your formula meets the demands of the best therapeutic thought in dentistry." On the other hand, it is pleasing to note that certain manufacturers do not stoop to such practices in advertising to the profession and the public. These may well congratulate themselves on pursuing a course which meets the approval of the profession.

VICTOR HUGO JACKSON, A.M., M.D., D.D.S. F.A.C.D.

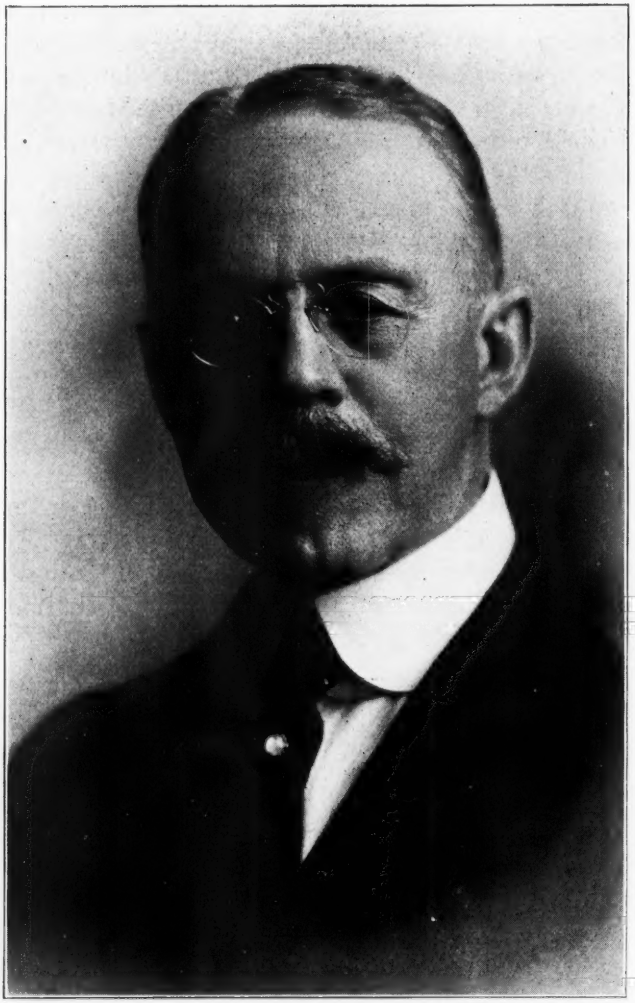
(1850-1929)

Victor Hugo Jackson, clinical professor of orthodontia at New York University, died Jan. 26, 1929, after a brief illness.

The New York University College of Dentistry mourns the loss of Dr. Jackson as an esteemed member of its faculty and one of its outstanding characters. A pioneer in his field, an authority of international recognition, he has given much to orthodontia and the profession at large.

Dr. Jackson was born in Arcade, N. Y., in 1850. He received his dental and medical degrees from the University of Michigan, beginning dental practice in New York City in 1879. He soon became deeply interested in the subject of orthodontia, carrying on exhaustive and persistent studies. He had devoted his time to this specialty since 1911.

Dr. Jackson was the author of various books on orthodontia and orthopedia of the face. The appliances which he devised and the principles which he practiced



VICTOR HUGO JACKSON, A.M., M.D., D.D.S., F.A.C.D.
(1850-1929)

became the property of the profession and made his name famous on two continents.

At Buffalo University, where there is dedicated in his name the "Victor Hugo Jackson Clinic of Oral Surgery," he was professor emeritus. He was a lecturer on orthodontia at the Forsyth Dental Infirmary in Boston, and, during recent years, was clinical professor at New York University, college of dentistry.

Dr. Jackson belonged to many scientific, social and civic organizations. He was a member of the district, state and national dental and orthodontic societies. As a friend and teacher, he leaves behind a host of admirers. He has been and shall continue to be an inspiration to those who carry on his work.

EDWARD M. GRIFFIN,
EGON NEUSTADT,
ABRAHAM LEES,
(For the Faculty).

JOHN H. BALDWIN, D.D.S., F.A.C.D.

(1861-1929)

John H. Baldwin, president of the Kentucky State Board of Dental Examiners, died of pneumonia recently at his home on Valley Road, Louisville, Ky.

Dr. Baldwin, who had been active in local and national dental affairs for forty-five years, was graduated from the Baltimore College of Dental Surgery, Dental School of the University of Maryland in 1883. For thirty-six years, he had been a member of the Kentucky State Board of Examiners, serving as secretary for twenty-six years. He joined the state dental association in 1884, serving at one time as president and at another as secretary. He had also held all the offices in the Louisville District Society at various times. Passage of the state dental law, which was later used as a model by other states, is credited to Dr. Baldwin.

In 1923, Dr. Baldwin became a Fellow in the American College of Dentists. He was a member of the Psi Omega national and Omicron Kappa Upsilon honor fraternities.

In 1924, a dinner was given in honor of Dr. Baldwin which was attended by leaders in the dental profession from all over the United States.

The widow and one daughter survive.

BUREAU OF CHEMISTRY

ORA-NOID

A "Synthetic Saliva" Preparation

ORA-NOID (Ora-Noid Company, 32 W. Randolph Street, Chicago, Ill.), is a recent addition to the constantly increasing list of dentifrices. The following is typical of the many letters received by the A. D. A. Bureau of Chemistry, requesting information on this dentifrice, sold to the profession as a proprietary, to the public as a nostrum:

Does the Bureau of Chemistry of the Association have a report on Ora-Noid?

This product is being so very insistently pushed onto the dentist that it makes me wonder about its merits if any. It *seems* to be extensively used (or recommended) by dentists, and is highly recommended by some quite prominent men in the profession (in some cases one wonders if it isn't for mercenary reasons).

The extreme secrecy of the formula, however, together with the too free distribution of samples (full size) and the almost ridiculously too liberal terms for trial arouses my suspicion as to its value. This feeling of suspicion is further intensified by the fact that a former member of the_____ State Board of Dental Examiners is visiting dentists over the state to spread the gospel and propaganda of Ora-Noid. It is not too much to presume that he is being paid for his services, probably liberally.

An early reply would be much appreciated as I should not wish to longer deprive my patients of the benefits of this preparation, *if it possesses the miraculous healing properties ascribed to it.* (?)!

Signed_____
Member of A.D.A.

What is Ora-Noid? Apparently, the formula of the proprietary is a deep secret. At an exhibit at a dental society convention, in response to a query as to the composition of Ora-Noid, the information was imparted by the one in charge of the booth that the Ora-Noid people would not divulge the formula for a million dollars! Evidently, this kind of business puts its promoters in the higher bracket income class.

One might suggest that an appropriate slogan for concerns of this type might be, "Millions for promotion, but not one penny for science."

According to a circular entitled, "The Newer Aspects of Oral Disturbances," "Ora-Noid may be roughly defined as a Synthetic Saliva." The booklet contains other equally startling and novel statements in which bombastic and pseudo-scientific truisms are interwoven. For example, the Ora-Noid people would give the impression that:

In the past too little attention has been given to the importance of this physiologic secretion (saliva).

The ridiculousness of the foregoing statement is apparent, for a perusal of the Cumulative Index Medicus for 1927 refers to about twenty-four articles on saliva alone, not to mention the host of articles on the salivary ducts and salivary glands.

In none of the articles does the name of Dr. O. A. Keller, of Chicago, appear. One is told that:

The Ora-Noid method was developed by Dr. O. A. Keller, of Chicago, after many years of experimentation during which the mouths of hundreds of babes were studied. By this study, Dr. Keller found the ideal proportions in which to mix the various vegetables and mineral salts so as to build up the saliva to its highest potency.

Who is "Dr. Keller"? The name of O. A. Keller does not appear in the American Medical Directory for 1927 nor in Polk's Dental Registry for 1928; nor does the name of O. A. Keller appear in the membership files of the American Dental Association. So much for the professional qualifications of Dr. O. A. Keller.

In view of the claims made for O. A. Keller's Ora-Noid, one wonders whether he is the Otto Keller who a few years ago exploited a pyorrhea "cure," using the trade style "Pyorrhea Institute of Illinois" and "International Pyorrhea Corporation"? The corporation was organized under the laws of Illinois in 1925 and had its Chicago headquarters at 154 E. Erie Street. Otto Keller was on the first board of directors. In 1926, the International Pyorrhea Corporation was exploiting "Zipco," another "pyorrhea treatment."

The Ora-Noid promoters are not modest about the claims for their product. One reads:

The Ora-Noid method is applicable to the treatment of pyorrhea at any stage in its progress.

The cause which permitted disease to enter the mouth should be corrected as soon as it is perceived, and when the Ora-Noid method is employed, pyorrhea and its symptoms will be prevented.

The dental profession is naturally interested in the treatment of pyorrhea, but before using a product, it should insist that it be scientifically tested, in both the laboratory and the clinic under exacting conditions of control. It is an insult to the intelligence of the profession to have foisted on it a product which is exploited with such an utter disregard of even the cruder requirements of accuracy and good faith. Exaggeration and secrecy are the hall marks of a nostrum!

The ignorance displayed in promoting Ora-Noid is almost naive:

Instead of seeking substitutes of saliva, we take the essential ingredients of saliva, put them into the mouth, and thereby supply a greater quantity of saliva with a sufficiently greater potency to enable it to do its work perfectly under abnormal conditions.

Reading further, one is informed:

Ora-Noid may be roughly defined as a synthetic saliva. It is a powder which includes all the various salts—phosphates and alkaline carbonates—contained in normal human saliva properly proportioned.

After reading the description of Ora-Noid, one is still left in the dark as to its exact composition. A formula is of little value unless it honestly expresses the qualitative and quantitative composition. The practitioner who wishes not to be remiss in his duty to his patient and himself should insist on the complete formula of any preparation used in the oral cavity.

MODUS OPERANDI OF ORA-NOID

Following the tale further, one may read:

Ora-Noid when dissolved in the saliva or blood forms a hyper-tonic solution of the salts of sodium, potassium, calcium and magnesium, based on the electro-chemical theory of hydrogen iron control. While the metallic salts contained in Ora-Noid are introduced into the saliva in the crystalline state, they soon unite with the blood and saliva and change to a colloidal state.

The jargon of the bygone days of the alchemists could not be more completely baffling. Again, one is told:

Ora-Noid is very close to a component of all the essentials of saliva.

Just what this means may be known to the promoters of Ora-Noid; to others, it is meaningless. It has the sound of high pressure salesmanship run amuck.

In the hope of yet finding something concerning the composition of this product, one delves further:

There is nothing in the Ora-Noid Powder with the exception of a few essential oils, that is not found in the constituents of normal healthy saliva. [Italics ours.—Ed.]

In order that the public and profession might learn something about this "Revolutionary Physiologic Method," the product was referred to the A. D. A. Chemist for investigation.

A. D. A. CHEMIST'S REPORT

"Two (2) original packages of Ora-Noid (Ora-Noid Company, 32 W. Randolph St., Chicago, Ill.), price $2.00 each, were purchased on the open market for examination.

"The following appeared on each trade package:

ORA-NOID
Powder and Mouth Wash
in One
Nature's own defense: SALIVA.

A scientific mouth remedy. Restores the normal chemical activity of saliva. Normal saliva is essential to a healthy mouth. Saliva functions against disease by direct contact. This is nature's own plan and weapon.

By using ORA-NOID no dentifrices or mouth washes are necessary.

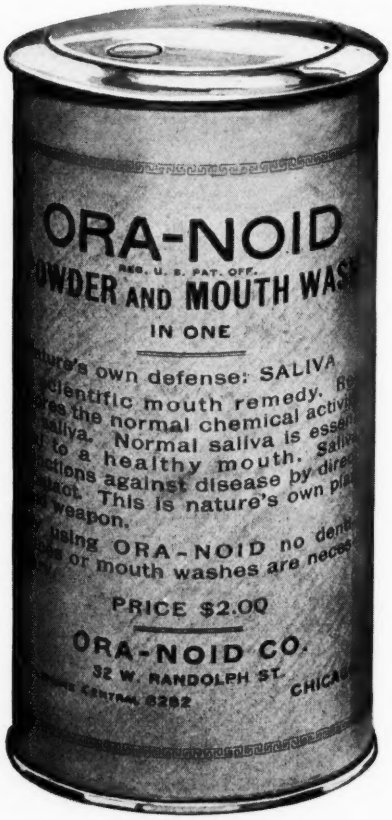
Price $2.00

Directions

Carefully brush the *tongue* as well as the *teeth* and *gums* with ORA-NOID powder twice daily and always at night before retiring.

Carry powder in the mouth freely for the first 30 days (teaspoonful). Dissolve powder in the mouth thereby creating a strong saliva.

The strong saliva produced by the Ora-Noid will cleanse the tissue as well as the tongue.



Ora-Noid container.

"The contents of one can weighed 208 grams (approximately 7 ounces); the contents of the other weighed 240 grams (approximately 8 ounces). For examination, the contents of both cans were bulked and thoroughly mixed.

"The contents were a fine, white powder, possessing a salty taste and an odor resembling that of oil of cloves and cinnamon. A small amount of relatively gritty material appeared to be present. The powder was not completely soluble in either cold or hot water, although the impression is given that Ora-Noid is soluble in the saliva. An aqueous infusion of Ora-Noid reacted strongly alkaline. This is in contrast to normal saliva, which is reported to have a slightly acid reaction.

"Qualitative tests indicated the presence of calcium, magnesium, sodium, potassium, carbonate, chlorid, borate and starch. Sulphates, perborates, peroxids, nitrates, iodids, tartrates and heavy metals were not found. Phosphate in more than traces was not found, although the claim is made that Ora-Noid 'includes all the various salts—phosphates and alkaline carbonates contained in normal human saliva. . . .'

"As saliva is known to contain normally the starch digesting enzyme ptyalin, it was of interest to carry out a series of tests to determine whether or not Ora-Noid was capable of digesting starch. Ora-Noid did not digest starch solution in half an hour; a few drops of saliva under identical conditions digested starch in less than five minutes.

"Quantitative determinations yielded the following:*

Moisture (drying over sulphuric acid)	1.4%
Moisture (drying at 100 C.)	8.2%
Insoluble matter† (acid insoluble)	0.4%
Calcium (Ca^{++})	7.5%
Magnesium (Mg^{++})	4.0%
Sodium (Na^{+})	19.7%
Potassium (K^{+})	1.1%
Chlorid (Cl^{-})	26.9%
Carbon Dioxid (CO_2)	15.8%
Starch	6.1%
Boric Acid Anhydrid (B_2O_3)	3.1%

"Based on the foregoing, it may be calculated that Ora-Noid (Powder and Mouth Wash in One) essentially has the following composition:

Sodium Chlorid ("Salt")	42.7%
Potassium Chlorid	2.1%
Sodium Bicarbonate ("Baking Soda")	6.9%
Calcium Carbonate (Chalk)	18.8%
Magnesium Carbonate	7.5%
Magnesium Oxid	3.0%
Borax ($Na_2B_4O_7 10H_2O$)	8.5%
Starch	6.1%
Moisture, essential oils and undetermined	4.4%
	100%

"The presence of the acid-insoluble material which had the characteristics of yellow grains of sand would indicate that materials of a lower grade than chemically pure were used.

"From the foregoing, it may be concluded that Ora-Noid (Powder and Mouth Wash in One) consists essentially of a mixture of table salt, baking soda, chalk, magnesia, borax and starch, flavored with essential oils."

Is it any wonder, then, that the Ora-Noid people keep their formula secret? The absurdity of the claims for Ora-Noid becomes apparent when the Chemist's report shows that Ora-Noid was found to be essentially a mixture of table salt, baking soda, chalk, magnesia, starch and borax, accompanied by a few grains of yellow sand. Practicing dentists will

*The details of analysis will be reported elsewhere.

†The insoluble material appeared to be small grains of yellow sand. When placed between the teeth, it gave a relatively gritty feeling.

appreciate that such a mixture never will cure or prevent pyorrhea. The rank and file of good dentists who practice rational and scientific dentistry will hang their heads in shame for their professional brethren who have allowed themselves to be misled into the uncritical use and prescribing of such a shotgun mixture. The unfairness to the patient of using such a mixture hardly requires comment but to say that the patient is entitled to more courteous consideration. The ridiculousness of the other statements sponsored by the Ora-Noid people may be judged from the composition of their product.

It requires a wild stretch of the imagination to conceive that the contents of a can of Ora-Noid costs more than 10 cents. No one doubts that, at $2.00 per can, there must be an enormous margin for profit, even allowing for overhead.

The statement that "There is nothing in Ora-Noid Powder with the exception of a few essential oils for flavoring, that is not found in the constituents of the protective normal healthy saliva" is at variance with the Chemist's report. This definitely is false, for it will be recalled that the Chemist found boric acid compounds in Ora-Noid. Up to the present time, boric acid or borax has not been found as a constituent of normal saliva. Undoubtedly, when the attention of the Food, Drug and Insecticide Division, U. S. Department of Agriculture, is brought to this flagrant case of misbranding, it will take proper action against the promoters of Ora-Noid.

It is a sad commentary on dentistry when dentists can be found who will write endorsements concerning a preparation of this type, marketed under such a host of falsehoods. It is all the more lamentable that the profession of dentistry is thus used by the none-too-scrupulous manufacturer as means of exploiting the unprotected public.

BUREAU OF DENTAL HEALTH EDUCATION

THE PROBLEMS OF PREVENTION*

By FRANK A. DELABARRE, A.B., D.D.S., M.D., F.A.C.D., Boston, Mass.

DENTISTRY is now passing through a critical period of readjustment of its purpose and ideals that broadens its field of endeavor and increases the responsibility greatly. The dream of many men for a long time is crystallizing in the conviction that, at last, to an appreciable extent, an effective means of prevention is possible. The brilliant progress made in the technical phases of our work and the overwhelming demand for our services blinded us to the real problem involved.

Sir William Hunter's vigorous arraignment of "Septic American Dentistry" in 1910 at McGill University forced the issue and compelled the study of the relationships of dental to general health and disease. The questions then aroused have not been settled yet, nor could they be by applying the old methods of curative effort.

The one item alone of focal infection following an abscessed tooth can best be eliminated by preventing the caries that is the exciting cause. The best of the innumerable methods devised for its cure are uncertain and disappointing.

Fortunately, many minds turned to the idea of prevention, and from the lessons learned in the clinics for school children, there has developed a method that holds the greatest promise of controlling or preventing dental caries.

Caries is the most prevalent of all human pathologic conditions. It begins soon after the teeth erupt and is rampant during childhood and youth. Statistics show that 84 per cent of children at the age of 3 already suffer from it; and within a few years, the percentage rises to 95.

The Forsyth Infirmary, established in 1914, soon found that its policy of admitting any child up to the age of 16 afforded no diminution of "repair" work offered. Gradually reducing the age limit for first admission to 7 pointed unmistakably to the solution and showed an amazing gain in effective control. Ultimately, no child over 2 years of age can gain admission and, as now, he will be ineligible after 16.

To this first practical advance was added Hyatt's demonstration that many teeth erupted with existing physical defects free from caries, and that these same locations showed by far the greatest number of cavities or fillings, later in life. Here, then, was the vulnerable area where caries most frequently started.

This previously neglected field has, in a short time, taken a commanding place in our thoughts, efforts and literature, and the insistent demand today is for the establishment of preschool age clinics in order to take full advantage of the new method of attending to noncarious pits and fissures as soon as possible after eruption.

Leaving the particular problems of children's dentistry for the moment, let

*Read before the Section on Mouth Hygiene at the Midwinter Clinic of the Chicago Dental Society, Jan. 14, 1929.

us face the whole idea of prevention of dental disorders in the wider aspects.

The human organism must be studied as a unit. All of the organs and functions are dependent on each other for their wellbeing. The vital organs are necessary for life, and impairment of any organ or function adversely affects the rest. Therefore, oral conditions must be studied from the standpoint of general health, and dentistry must be classed as a true "health service," when the general practitioner pays as much attention to children as he does to adults. The main thing now is to acknowledge the burden placed on our shoulders and assume the task of doing our work for the sake of maintaining or improving health.

Compared with the whole, the dental problem occupies a minor place, but it is none the less important, because we know today that dental lesions may be the starting point of a chain of pathologic conditions that may result in premature death, through involvement of some vital organ. It is not necessary to determine the measure of its responsibility at once; that will be developed along with increasing knowledge of cause and effect.

Prevention may be secured in two ways: by finding the causes, both activating and contributory, and applying the appropriate remedy, i. e., prophylactic therapy; or by increasing the normal resistance and immunity of the body so that natural forces will render them incapable of harm.

If the statement that "dental prevention is effective in inverse ratio to the age of the patient" is true, it is logical to exclude from this survey such conditions as are not common in childhood, and to look for the solution in the means that can be applied to the masses rather than to individuals.

Of the two possible lines of attack, the greater result will come from the effort to improve the resistance and immunity of the bodily unit as a whole, which will have the greatest influence for general health. This is essentially a medical problem but one in which we have great concern and to which we may render some small degree of aid, particularly by attention to the contributing causes of disease and by maintaining the integrity of function in the oral cavity and closely related functions. Local hygienic measures are essential even if they fail to keep a "clean" tooth free from decay because of their inability to reach the "most vulnerable areas."

Growth and development are largely dependent, aside from hereditary influences, on the influences of the ductless glands and a proper diet, effectively assimilated and distributed. The oral function is closely concerned with the digestive function, and it is our task to maintain or restore its efficiency. While positive benefit may be expected from the further development of endocrine therapy, the application of dietary measures offers the best results at present. Our profession can aid, by educational effort, to overcome the inertia and indifference of the public, confused by the variety and contradictions of the many food fads. Our relations with the public place us in a peculiarly fortunate position to do such educational work, since frequent and periodic appointments, particularly with children, give a contact which medicine, as a whole, does not enjoy. Then, too, we can supplement the pediatrician's effort to eliminate the contributing causes of poor nutrition, such as an improper balance of daily activities in play, rest, work, sleep, exercise, fresh air and sunlight, without which the best

dietary is badly handicapped and ineffective.

Education in mastication is indicated in many cases and the teachings of Fletcher should not be forgotten.

Metabolism is a very complex problem, not to be solved by one line of approach, but which requires all the skill and knowledge that medicine and its related sciences can give.

From our experience in age control, it is reasonable to expect that better, stronger, more resistant teeth will result from the intelligent medical care of the expectant mother, in regulating the diet and living conditions to maintain the desired balance of elements necessary to tooth formation. The Forsyth Infirmary has had a prenatal clinic in operation for several years.

Anything that medicine can do to improve the health of the mother and child and raise the physical tone and vigor will tend to simplify our dental problems. The earlier this help is given, the better the chance to provide immunity from caries.

Even today, immunity to caries has not been entirely lost by the refinements of diet and manner of living that "civilization" has brought. There are individuals and races who show a relative immunity, and we know that age confers a measure of it to many. Therefore, we may hope to restore, by some such means, the immunity that mankind once enjoyed. It is entirely possible that the future will develop methods of arresting decay and prevent further occurrence by a combination of curative and preventive treatment. It is admitted that practically all dental effort results in a degree of prevention, but only for the individual and generally after childhood.

Concerning caries, it must be admitted that dentistry's effort at control by curative procedure has been a relative failure, carrying little preventive benefit; else why do we boast of a filling that has served for twenty or forty years? Whatever the active cause may be, whether chemical or due to micro-organisms or both or whatever combinations of contributing factors are present, the fact remains that caries has occurred, and it is too late for real prevention.

To supplement these efforts as outlined, there remains one practical means of the greatest importance that will give immediate results, and that is, dentistry for children, which is partly preventive and partly curative. It is truly preventive if the remedy is applied before disease occurs, even though the mechanical technic is the same used in all our curative procedure; and the results of the curative effort for children are infinitely superior to any obtained in all our previous history.

The dentist does not see the child until the teeth appear. Much of the success of his efforts depends on what has gone before, but the full measure of success cannot be secured without the assumption of his full responsibility. It should be unnecessary to emphasize the need of early, periodic and systematic visits for control and prevention, during all the years of development. Dentistry is not now so much a curative measure as a *preventive health service.* It is no longer a local problem, and its relation to general systemic conditions must be uppermost in mind.

There is need for a careful diagnosis in each case, based on a case history that supplements the medical case history. The common indices of health, such as the height-weight index, the color of the skin, the posture, the expression of the face and the mental attitude should be included, as well as the occurrence of

disease. The cooperation of the pediatrician or the family physician is desirable in all cases, when indicated.

The symptomatology of the mouth should be always noted at each visit in order to detect the signs of disease, particularly those that find entrance through the mouth and nose and often reveal their presence there first, such as the eruptive fevers, measles and scarlet fever.

The technic in children's dentistry is practically the same. The only modifications are occasioned by the differences in the structure of the deciduous teeth, the problems incident to the rapid growth and development of the dentition and the changes that occur in occlusion from infancy to adolescence. Elaboration of this newly adopted point of view is precluded by time, but its practical value cannot be overemphasized.

Function is the basis on which to estimate the value of any organ. A mouth may be free from disease and yet not function efficiently because of malocclusion. Malocclusion appears early in life, in the majority of cases, and the child that does not show evidences of normal growth and development needs attention. A knowledge of such development is essential to any dentist handling children, and, more than that, an understanding of the causes of malocclusion, many of which could be eliminated. Particular emphasis is placed on the pernicious habits of infancy and childhood, such as sucking habits, faulty speech, mouth breathing and improper posture. Breaking them may actually prevent malocclusion, and will in any event lessen the severity of complications in a case due to other causes.

It should also be appreciated that, later in life, malocclusion renders the individual more susceptible to caries and pyorrhea in addition to his being functionally handicapped.

Dental Health Service for children is not complete without inclusion of orthodontia, which is no longer undertaken for esthetic reasons alone, but mainly for the improvement in health that results from restored function.

Our efforts to gain the acceptance of this line of procedure in practice introduces into professional education new problems that are of greatest importance and require immediate attention. It is from this source that the most rapid progress may be expected.

In spite of rapid advances, our education and training do not qualify us as a profession to deal with the underlying fundamental causes. That is the province of medicine. Still, there is the increasing obligation resting on our professional schools to augment the teaching of medical sciences to the point where the graduate will be equipped to understand and appreciate the single aim of the two professions, having gained sufficient knowledge of the dependence of all tissues on the laws of physiology and pathology to recognize the existence of general causative factors and injurious end results.

Since children's dentistry provides the best opportunity for realizing the highest attainable measure of prevention, more to be desired than any curative success, there are educational adjustments necessary to insure the acceptance by the young graduate of this new point of view, which changes so radically the relative values and desirability for the patient of the various technical procedures as taught.

While he still should be free to choose any specialty that he may desire, he must be made to appreciate the fact that better dental health can be assured more people

by means of children's dentistry than in any other way. If this is true, it must be given the place and dignity of a separate course under a qualified professor, and properly correlated with all other courses. In fact, this radical change in policy upsets the whole curriculum and forces a readjustment and balancing of hours and requirements all along the line. Better coordination with dental and medical teaching will be the result. If it is apportioned out among the various departments, the subject will not be adequately presented and will suffer from lack of interest, unity and coordination, and will not carry conviction to the student mind.

A separate clinic for children is imperative because the object is different, and the psychologic problem is more easily solved by handling the children alone.

There remains another educational problem that is rather discouraging, but fortunately time will solve it. It relates to the acceptance of this whole idea by the profession at large. Organized dentistry has been educated to accept it as logical and inevitable; the individual dentist has not, and as a profession we are not prepared to give the service that the public will soon demand.

Our literature is giving a good amount of space to the subject, and programs of societies and conventions list it in papers and teaching clinics. The Massachusetts State convention next May will feature children's dentistry in its relation to all other branches. More study clubs should be formed everywhere to stimulate interest and explain the detail. The medical profession should likewise be made acquainted with the fact that dentistry has awakened and wants to cooperate.

Short informatory courses should be included in the medical schools, and the leaders of our profession should make every individual effort to bring the matter to their attention. In this connection, care should be taken to avoid extravagant statements; but it can be truthfully said that our help has been asked for, and we have now found a way and modestly offer to do what little we can to conserve public health.

The task of educating the public should be easy because all parents love their children and want them to have advantages denied them in their own youth. But all effort in that direction should be supported and sponsored by *responsible dental organizations* and not left to individuals or unprofessional bodies.

There is another outlet for the promulgation of this idea that is already in action in some states; that is, contact with state boards of health, either through committees or an individual appointment. Much can be done along this line in determining and standardizing the policies and conduct of existing or proposed school clinics. Much confusion can be avoided and mistakes prevented by proper advice to communities from this source.

There are already a number of specialists successfully practicing on children only and doing very remarkable work. And there has been formed a national society for the promotion of children's dentistry.

Specialization along this line will be advantageous in making progress in research and improved technic, but it will never fulfil our obligation to the public. It will not solve the problem. That can only be done by having the bulk of the profession give this service to the children. Such service is in no sense *per se*

a specialty of dentistry. It is merely dentistry applied to a particular group, and in this respect exactly parallels pediatrics in medicine.

The combined efforts of the pediatrician and the dentist, whose aim is the maintenance of health rather than the cure of existing disease, should secure for the child the best possible physical equipment.

520 Beacon Street.

TAKING INVENTORY OF OUR MOUTH HYGIENE PROGRESS*

WILLIAM R. DAVIS, A.B., D.D.S.,† Lansing, Mich.

THE time of year suggests inventory. All going concerns today recognize the importance of taking stock at certain intervals, calculating losses and gains, and, from this survey, determining policies for the future. This is absolutely necessary today in successful business. Hit or miss methods cannot succeed. But it is also very essential to take inventory in organizations and movements, although here profits and losses are more intangible and harder to evaluate. Honest attempts in this direction must be made if any movement is to continue to command respect and support, especially from those not directly connected with it and whom it wishes to ally to its cause, and also in order to accomplish its task most efficiently. Let us make a rather hasty attempt in this direction in regard to some phases of the mouth hygiene movement.

While there were a few "voices crying in the wilderness" in generations past, this movement really took its beginning in the early part of the present century, when the efforts of B. Holly Smith and W. G. Ebersole first began to attract attention. It is just twenty years since Dr. Ebersole became chairman of the Oral Hygiene Committee of the National Dental Association, and one year later, he conducted the first real experiments to test the effects of mouth health on scholarship and general health, the now famous Marion School experiment in Cleveland. I think we can call this the first real impetus given to mouth hygiene as a part of public health.

In 1911, Dr. Ebersole organized the National Mouth Hygiene Association, working indefatigably in behalf of this cause, until broken health and finally death took this great pioneer from our midst. The organization did not long survive its moving spirit. While mouth hygiene gained some attention and converts, it had not yet begun to stir even many of the leaders of the medical or dental profession, to say nothing of the rank and file, public health organizations, or the general public.

It remained for a physician of England, Dr. Hunter, to "fire the shot heard

†Director of the Bureau of Mouth Hygiene, Michigan Department of Health.

*Read before the Section on Mouth Hygiene at the Midwinter Clinic of the Chicago Dental Society, Jan. 15, 1929.

'round the world" when he gave his indictment of some modern dentistry and mouth conditions and their effects on general health. This criticism of dentistry compelled the attention of the dental profession, and when he was followed by such men as Charles H. Mayo, the great surgeon, and William Osler, the great internist, who emphasized the effects of mouth infection on general health, both the medical profession and the dental profession began to take notice. The past fifteen years have seen a great awakening in regard to the importance of mouth health, with many programs and efforts to improve conditions. This period has seen and been responsible for the formation of a new profession, that of the dental hygienist; outstanding experiments such as the one at Bridgeport; the establishment of two great dental infirmaries, at Boston and Rochester; the development of many school, industrial and institutional dental programs; the appointment of full-time dental health workers in many state health departments; the establishment of a division of mouth hygiene in our national dental association, with a full-time dentist in charge, and some realinement and emphasis in dental education in more accord with the place dentistry must take as a health service. This is just to mention a few of the high spots. To outline in some detail the development of the past few years in mouth health would require all and more than the present time at our disposal and is not necessary for the purposes of this paper.

We wish especially to note some of our weak spots and the policies most needed for the future. As a profession, we have a right to be proud of the progress that the last twenty years have witnessed, but it is really only a beginning. As a matter of fact, except in isolated cases, not very much of a dent has been made as yet in that great problem, the incidence of dental caries and mouth infection, even in many places where programs have been in progress several years. The mouth hygiene movement has gained some recognition and has developed some machinery. The next twenty years must see a greater output in improved mouth conditions. What are some of the things necessary to that end?

Now, if I were to ask: "What is the outstanding emphasis today in our mouth hygiene movement?" I believe that all would agree that the watchword is "education." We hear that on all sides. Every dental health worker is continually being told that his great task is education. Mouth hygiene committees are emphasizing education. New organizations in dental health that are springing up are emphasizing education and outlining great plans in detail. Dentists are being marshalled into platoons to go out and educate. Noon-day clubs, women's clubs, parents, teachers, schools, newspapers, magazines, all are to be bombarded with lectures, films, radio talks, pamphlets, plays, etc., in a great campaign of education.

Now, there are elements of strength and elements of weakness in all this. In the first place, it has resulted in material intended for education being prepared too hastily, material which is, moreover, open to much criticism.

At a recent joint meeting of the American Public Health Association and American Child Health Association, dental health education material was discussed from the standpoint of subject matter and pedagogic value. The position taken was that, in subject matter, it should adhere to the truth and the truth in proper relation and balance and not distorted, as far as we know it, from

scientific and clinical evidence. Furthermore, as material designed to teach, it should conform to correct fundamental pedagogic principles. It was a matter of some chagrin to find how much both these rules were violated in much of the material submitted. The truth is that much dental health educational material has been produced with rather feverish haste and without a clear idea of what it should do or how it should do it and without consideration of sound teaching ideas. Consequently, it often makes statements that are not true or are out of focus, and it does not command respect either for its adherence to facts or its construction. The crying need is not for *more* material but for *better* material. I believe that the mouth hygiene division in the American Dental Association office is in a position to do a great service in this matter. This is the logical clearing house. Instead of a storehouse for *all* kinds, let it be a clearing house for the *right* kind. Let it O. K. and have for distribution, sale or copy material that is generally agreed on by scientists and clinicians as truth in proper balance and by competent educators as conforming to correct pedagogic principles. Parent-teacher, health and educational organizations are asking where they can get such mouth hygiene material today, but the discriminating ones do not want to use much that is offered them, and we should not want them to use it. Not only is much commercial material pernicious, but some dental organizations have produced a great deal that is open to criticism. Not many dentists are versed in pedagogy or education or public health; consequently, the association of others not dentists is needed in the development of this material. Let us back up our national bureau in an endeavor to develop educational material that will command the respect of educators and public health workers. Let us not stampede them into going faster than sound fundamentals will justify. In such a way will more progress be made in the long run.

In the second place, there is too hazy an idea in the profession today as to the *purpose* of dental health education. Many seem to think that it is an end in itself. They seem to think that education of the public is in some mysterious way going to solve this whole problem. I wish that this were true, but I respectfully submit that we do not know how education itself is going to extract or treat teeth or fill them.

I have said before and I believe that I cannot reiterate too often that education is only a means to an end and that end, as far as a dental health program is concerned, is the elimination and prevention of mouth infection. Only the dentist can eliminate dental infection. One of the chief factors in prevention is early filling, and only the dentist can do that. Consequently, any education that is going to accomplish its purpose must mean more available dental service to those who need it. We cannot dodge that responsibility. Now, there are some large factors here which the dental profession alone cannot solve but which it must face. Leaving out of consideration for the moment the economic factor, I wish to say that, even with all our inadequate educational program, education of the public is progressing faster than the dentists are meeting it. Consequently, right now, our educational program needs to emphasize the education of the *dentist* more than that of the *public*. This was shown by the letter published last year in THE JOURNAL from the president of the National Parent-Teacher Association. It is shown by the questions asked by teach-

ers and nurses concerning their problems in mouth health. It is shown by the remarks of mothers when we make a school examination before them. Almost universally, the baffling question which those of us in this game face is: "My dentist said to 'leave them alone,' " or "My dentist does not work for children. Where can I get my children taken care of?" and this often by people able and willing to pay for the services. There is no question about the interest today of the majority of school nurses, teachers, mothers' clubs, etc. The thing I most fear is the reaction of these groups because of the discouragement as to getting actual results. No, we need education, but right now the need for the education of the dentist himself is acute. We do not need public speaking classes for dentists or great educational campaigns for the public half so much as clinics and classes which will teach the dentist child psychology, management of child patients and children's dentistry. Not all dentists can be public speakers, and they do not need to be, but the majority of them at least ought to know how to take care of the dental needs of children. If you doubt what I say, come with me into a school or before a mothers' club, or talk with dentists themselves. Within a few months, several recent graduates have talked to me about the lack in their college education of a course in management of children and the essentials of children's dentistry, and urging that dental colleges give more attention to this. We must insist that our colleges meet this need adequately, and we must have more topics on child management and children's dentistry on our general programs. We cannot relegate this matter to the child specialists. For the most part, children's dentistry must be the work of the family dentist, especially simple extractions and fillings, and these two things are the great factors at present in public health as it pertains to dental practice. Diet is important. Cleanliness should be encouraged, but unless means are available for the removal of infection and the insertion of early fillings to prevent inroads of decay and infection, no mouth hygiene program can get very far.

We are speaking now of patients who can pay and are willing to pay. Some dentists are temperamentally constituted so that they cannot work for children, but not nearly so many as *think* they are. However, they should not say "leave the teeth alone." If unable to work for people willing to pay, they should tell them where they can get dental service for their children. But even if the parent is unable to pay, the dentist should not say that the child does not need dental service if it does. How it is to *get* this service in those circumstances is another matter and not the responsibility of the individual dentist.

We realize also that this brings us up against the most baffling problem of all, and that is the economic phase of this question. There are four facts that need to be faced in this connection: 1. The tremendous incidence of dental disease in all classes of people from preschool age to the adult, from 50 to 80 per cent of all children entering school, from 75 to 95 per cent of school children and 80 to 90 per cent of industrial and institutional groups, as well as the entire adult population being affected. 2. The great amount of time necessary to prevent and correct dental disease as compared with correction and prevention of many other diseases. 3. The fact that there are not nearly enough dentists to assure the treatment and prevention that can be done only by dentists. We know that

only a small fringe of the whole population ever have had any adequate dentistry and that there are not dentists to care for more than this fringe. But this does not mean that a sufficient number of dental graduates will solve this problem by any means; not until a fourth problem is solved, and that is, the fact that a large number of people cannot afford dentistry, or at least *think* they cannot afford dentistry. We do not need a very much larger number of dentists until we know how the mass of people are going to get their services. Read "Dental Care and the Family Budget" in the November issue of THE JOURNAL. How can a family with several children get adequate dentistry on an income of less than $2,000 yearly and many of them on an income of only about $1,000 or less? And yet there is good evidence that 86 per cent are in those classes. When our boasted prosperity is considered, a survey of yearly family incomes in a small town or any city is occasion for a surprise. The daily wage does not tell the whole story. Now, the dental profession alone or the mouth hygiene movement alone is not called on to solve this problem, but is called on to *face* it. It is the one that the teacher, the nurse and the health worker are up against all the time in their efforts in health education that is to accomplish results. We have not the temerity to offer a solution, but we do urge that it be given serious thought and that the vague term education or dental clinics for the indigent alone will neither one solve it.

Another aspect of our mouth hygiene movement which is evident in any survey and which deserves mention is the fact that it has developed too much alone and apart from other health problems. This is not surprising when we consider the attitude of the medical profession and public health organizations in the beginning. Then, they had no place for us, and this was unfortunate for both. However, that is not true today. Dentistry is now recognized as a part of health service, and mouth conditions are recognized as a very large problem in public health. Health organizations have open doors for the dental health workers. We need to go in. We need contact with them and they need us. That is very evident whenever we do get together. How many dental health workers are affiliated with or attend meetings of health organizations other than mouth hygiene sections of dental meetings? As a matter of fact, almost none, and yet I believe that here at present is one of the greatest opportunities for service to ourselves and our cause. We need the broadening contact with all health problems of which ours is just as part, and other health workers need us, for no general health movement can ignore the mouth. We do not want to be a separate section in these organizations but to be a part of each related section, such as health education, industrial health and maternal, infant and child welfare.

The American Public Health Association and the American Child Health Association have recently combined their meetings for greater efficiency and service. Dental health workers should be affiliated with this great group and they should be associated with other health workers of their town and state.

Even the mouth hygiene sections of our dental meetings have developed too much alone. There is too much overlapping of programs attended by small groups when different sections are discussing subjects of mutual interest. The whole body of dentists need to hear some of the real problems of dental health discussed, and the only place to reach them

is at our various local, state and national meetings. Comparatively few read the magazines; and fewer still, articles dealing with the dental phases of public health. They are very willing to leave all these matters to their mouth hygiene committees or employed health workers. They must be jolted out of that complacency and made to see that preaching and promotion are not "the be all and the end all" of mouth hygiene. These cannot take the place of operative instruments at the dental chair. The profession must be made to see that mouth hygiene has to be *practiced* in the dental office as well as *preached* from the house top. This is going to mean more attention to the dental phases of the subject in all our meetings, as was discussed under education.

Another phase of the mouth hygiene question that any inventory soon discovers is the evidence that there are a great many different plans and programs in existence today, but no very clear evidence as to costs and results. This makes evaluation difficult. This was to be expected in the beginning, when the movement was new, but the time has come when we need more definite information. A good analogy is found in the case of the automobile industry, which has also come to the front in the last twenty years. Ten years ago, there were many more makes of cars than there are today and each one represented an individual effort. Almost anything "got by" in those days; but not so today. Think of the infinitely better product now to be had and at less cost, as compared to that of a few years ago!

What has brought about the change? Efficiency and engineering skill concentrated on that object. The General Motors Corporation has, near Milford, Mich., a large proving ground with every kind of road condition and hills of various known angles. Not only their own product but also every make of car is put through the paces, and competent engineers check their performance from time to time to find their strong points and weak points. It costs something to do this, but it is worth it many times. We need some proving grounds in public health programs. Figures and statistics mean little unless compiled upon some uniform basis. The survey and report on dental education by the Carnegie Foundation is an outstanding example of a splendid effort in this direction in the field of dental education. I consider this one of the most important and far-reaching things that has happened in dentistry in many years. This was not done by dentists but by an educator who went into all phases of the subject. It was not done hastily but with painstaking care. The result is a classic that will profoundly influence dentistry for good for many years. While devoted to dental education, the preface and earlier chapters should be read and reread by every dental health worker. Here is an exceptional analysis of dentistry as a health service.

Another survey which every dental health worker should read and reread is "Dental Clinic Services in the City of New York," both the 1924 and the 1928 edition. These, too, were not made by dentists, but by workers skilled in evaluation and analysis. The first shows especially the haphazard results of just starting something without plan or organization or supervision, and they both show very keen analysis of the whole problem and give excellent suggestions as to organization and service. We need more such careful and unbiased surveys of plans, programs and materials. Perhaps here again, our national Bureau can func-

tion by getting the proper organizations or people to do this task. It must be done in a way to command universal respect as do the Carnegie report and the New York Clinic reports. It cannot be done hastily and by any one.

In conclusion, let me summarize by saying that the mouth hygiene movement is just emerging from the pioneering stage. We have a right to be proud of the accomplishments, but they are only a beginning. We have developed too much alone and must have more coordination. We must keep in mind that our aim is the removal and prevention of mouth infection. Education is a means and not an end. There is a crying need for not more but better educational material. Education of the public is going faster than education of the dentist. More attention to the latter is needed right now. The economic aspect must be faced and given serious consideration. More careful evaluation of plans and programs with reference to costs and results needs to be made.

We close with the words of that great and honored pioneer, W. G. Ebersole: "Honest and conscientious criticism has wielded a wonderful influence for good and those who are doing things worth while welcome it as an agent which points to possible weaknesses, thus giving opportunity to correct unseen faults."

MISCELLANY

BOOK REVIEWS

A Text-Book of Oral Pathology for Students and Practitioners of Dentistry. By Russell W. Bunting, D.D.S., D.D.Sc., Professor of Dental Histology and Pathology, University of Michigan, Ann Arbor, Mich.[1] 326 engravings and 1 colored plate; 495 pages; price, $7.00 net. Published by Lea & Febiger, Philadelphia.

The author of this book has been so well and favorably known in the profession that anything coming from his pen will demand instant and careful attention. Naturally, in view of his past research work, he stresses more than any other topic the consideration of dental caries, and any one who desires to inform himself on the latest development of this subject should read this book. Evidently, the author is much impressed with the work done on dental caries by the late W. D. Miller, as indeed must every one be who studies it. Dr. Bunting elucidates Miller's theories not only in text, but also in illustration.

The author of the present volume has studied the relationship between the presence of *Bacillus acidophilus* and the occurrence of caries for years; and in his book, he makes the following significant statement: "In a bacteriologic survey of carious and noncarious mouths, in which over 2,000 cases were examined, it was found that *B. acidophilus* was present in practically every case of active dental caries. Out of this entire group there was but one in which caries was manifestly active and the organism could not be found. Conversely, in those mouths which were free from dental caries or in which the disease had become inactive, the organism was almost invariably absent. In several instances when it was present in a seemingly immune mouth, on later examination it was found that dental caries had become active. In its occurrence, therefore, *B. acidophilus* bears a definite relationship to dental caries which may be said to be as specific as any infectious disease."

It is a pleasure to recommend a book which shows such a broad grasp of the subject, and which presents the theories of so many previous writers. Not one of the least of the commendable features is the liberal bibliographic references with which the book is enriched.

We congratulate the author on the painstaking care with which he has prepared his material, and the publisher on the mechanical excellence of the book.

Care of the Mouth and Teeth. By Harvey J. Burkhart, D.D.S., LL.D., Director, Rochester Dental Dispensary, Rochester, New York. 45 pages. Published by Funk and Wagnalls Company, New York and London.

This is one of the National Health Series, edited by the National Health Council.

It is filled with good common sense advice which, if followed, will contribute to the welfare of the individual. It considers an astonishingly large variety of subjects, and it has the one outstanding virtue of telling its story without waste of words. This is so unusual in a book of this kind as to be noteworthy. It is well illustrated, which adds to its value and attractiveness.

Dr. Burkhart's long experience as a practitioner and as director of the Rochester Dental Dispensary has fitted him admirably for the task of producing such a book, and the result is a most satisfactory volume. We bespeak its careful perusal by every one interested in the subject.

Your Teeth. By Charles I. Stoloff, D.D.S. Illustrated; 224 pages. Published by E. P. Dutton & Co., Inc., New York.

The first paragraph of this book reads as follows: "When a dentist sticks his little mirror into your mouth, reaches for that terrible electric drilling machine, starts boring away into your tooth, and then reaches for a long thin wicked looking wire instrument with which he purposes to remove your nerve or clean your root canals, you probably wonder what it is all about, whether it is going to hurt, and how carefully and skillfully the work is being done. It he is conscientious, and asks you to return several times to have the same thing done and perhaps a little bit more, you wonder what prompts him to do so, whether it is the pleasure of your company, the padding of your bill, or "much ado about nothing."

The purpose of the book is to educate the public in dental matters, and it would seem to be a legitimate query to ask, "What would be the effect of this paragraph on the average lay reader?" It would seem that it might raise a question as to the desirability of approaching a dental office. We believe that a more pleasant prospect might have been presented to the possible patient, and it surely would have been more in keeping with the ostensible object of the book, as the author says later that "This book is an endeavor to elucidate the basis of contemporary ideas of dental prophylaxis, and the logic of careful restorative dentistry."

The plan of the book is along the lines of questions and answers, and this is a very effective method of presenting a topic of this kind. Some of the information given would appear to apply more to the profession than to the people, while in other places the author clearly had in mind only the laity. It would seem preferable to write either for the one audience exclusively or for the other in order to convey the message more effectively.

Publicity for Social Work. By Mary Swain Routzahn and Evart G. Routzahn. Published by the Russell Sage Foundation, New York.

This book is issued from the Department of Surveys and Exhibits of the Russell Sage Foundation, and is well worthy of study by those interested in welfare or social work. A single paragraph in the preface gives a glimpse of the purport of the book. It says: "A characteristic of publicity for social work is that it urges information upon people who do not seek it. An effort to induce them to give money or service to relieve suffering, to change personal habits, or to acknowledge and correct injustice must often be unwelcome. To secure their attention under these circumstances necessarily requires an agressive process of overcoming indifference and of creating a desire for understanding."

Numerous illustrations throughout the book give typical examples of posters, etc., used in campaigns for raising funds for various philanthropic purposes, and the problem of social service is considered in great detail.

It is a most interesting and illuminating presentation of the subject and one that will appeal to every one engaged in welfare work, containing as it does many useful practical suggestions for approaching the public and making philanthropic appeal.

Teamwork for Child Health—Suggestions for the Year-Round Program in Home, School and Community. How May Day Can Help. Published by the American Child Health Association, New York City, 1929.

This pamphlet of ninety-three pages contains much significant information relative to the various activities associated with child health. The dental profession must line up with the other health agencies in all constructive efforts to improve the race, and the

American Child Health Association will be found most willing to cooperate with the profession in every advance tending to the welfare of children.

THE KELLS MUSEUM

Before the death of Dr. Kells, the dentists of New Orleans had started a museum in his honor, and it was a source of great satisfaction and pride to him to see the splendid beginning that was made, and to note the promise of a steady growth through the donations of friends from all parts of the country. It is the desire and ambition of the committee in charge to build up a museum worthy the name of the nobleman in whose honor it was founded, and they are anxious to receive donations from any one who feels like contributing to this worthy cause. What they most require to round out the collection are old books or instruments or dental apparatus of any kind. Most practitioners have such things lying around the office or tucked away on shelves where they are doing no good to any one and the committee will welcome such donations. They may be sent to the chairman, Dr. S. S. Grosjean, 839 Maison Blanche, New Orleans, La. Let us remember the good that Dr. Kells did for dentistry, and let us try, in a small measure at least, to repay the debt we owe him.

IMPORTANT INFORMATION RELATING TO DEDUCTING TRAVELING EXPENSES WHEN FILING INCOME TAX REPORTS

The United States Board of Tax Appeal has rendered a decision reversing the ruling of the Commissioner of Internal Revenue in not allowing as a deductible item the traveling expenses of professional groups in attending scientific meetings. This decision is subject to an appeal by the Revenue Department, but it is generally understood that it will not be further contested and I suggest that such expenses, which include transportation, hotels, meals and such other necessary expenses, be deducted when filing your income tax report for 1928. This should be deducted in Line 16 Schedule A. Form 1040 and, in the space provided at the bottom of Schedule A, an explanation of this deduction should be made, specifically stating that the deduction represents expenses incurred in attending dental meetings. This decision does not permit of including expenses incurred in attending clinics and postgraduate courses, as such expenses are held by the Treasury Department to be nondeductible. In the event that this case is not appealed, and later reversed, every taxpayer who has not been permitted to deduct such items heretofore can, if he so desires, file claims for refunds for such years as are not nullified by the expiration of the fixed time limit under which all claims must be presented.

I also desire to call your attention to the fact that incomes from professional fees, salaries, etc., not exceeding $30,000 net may be considered as "earned income" and thereby subject to an "earned income credit." Also, the war tax paid on all club dues is a deductible item as well as all other taxes and license fees paid, with the exception of the amount paid as income tax and items charged on your county tax bills for local improvements, such as street paving.

You are probably aware that we have recently cooperated with other professional groups in an effort to secure some corrective legislation specifically providing for the deduction of such traveling expenses, and that the Senate, by a vote of 59 to 13, adopted an amendment by Senator Copeland, of New York, providing specifically for such deductions, but this was not retained in the report of the Conference Committee representing both branches of Congress. However, we appreciated, and so stated at the time, that this was a matter of regulation rather than legislation, and in the foregoing my position has been fully verified.

This information was not available in time to present it in the February issue of THE JOURNAL, but I have mailed joint circular letters to the presidents and secretaries of all the state dental societies, as I thought possibly they could get it to their members through bulletins or the meetings of their component societies, in order that they might be advised as promptly as possible regarding the situation, since all income tax reports must be filed by March 15.

Respectfully Submitted,

HOMER C. BROWN, *Chairman,*
Committee on Dental Legislation
American Dental Association

609 Hartman Building,
Columbus Ohio.
Jan. 30, 1929.

NEWS

Death of Colonel Armstrong: Col. John Alexander Armstrong, C.B.E., C.M.G., who organized the Canadian Army Dental Corps in 1915 and took it overseas, died recently of heart disease in the Civic Hospital in Ottawa, Canada. Colonel Armstrong was one of the best-known surgeon-dentists in Canada. He served as director of dental services of the overseas military forces of Canada from 1915 to 1919.

Dr. Houston Retires: William Preston Houston, after thirty-eight years of continuous service as assistant professor of clinical dentistry and instructor in the infirmary of Tufts College Dental School and in the Boston Dental College before its coalition with Tufts, retired recently. Quoting from *Tufts Dental Outlook,* December, 1928: "As a pioneer of Tufts College Dental School, he has by his example and efforts ably assisted in the raising of the standards of the school and of the profession from that of a vocational training to the height of a science and a profession of health service. We regret that succeeding generations of Tufts men will lose the benefit and pleasure of association with one of the members of that gallant triumvirate—Drs. Houston, Piper and Daly."

Testimonial Dinner to Dr. Kirk: Edward C. Kirk, professor emeritus and former dean of the School of Dentistry and Evans Dental Institute of the University of Pennsylvania, was honored recently at a dinner at the Bellevue-Stratford Hotel, Philadelphia, on the occasion of his completion of fifty years' activity in the dental profession. Two hundred and fifty guests were in attendance from all over the country and from several foreign countries. Harvey J. Burkhart, president of the Eastman Dispensary at Rochester, N. Y., who acted as toastmaster, paid tribute to Dr. Kirk as the man who has done more than any one else to bring about international understanding and to cement international good feeling in the profession. Provost Penniman extended the greetings of the university and spoke on Dr. Kirk "the educator." Edwin T. Darby, professor emeritus of operative dentistry and one of the founders of the university, spoke on Dr. Kirk as a friend. Dr. Darby taught Dr. Kirk chemistry fifty-one years ago, and signed his diploma in dentistry fifty years ago. Dr. Kirk served as dean of the dental school and professor of dental pathology, materia medica and therapeutics from 1896 until 1917, when he was made professor emeritus. He holds the honorary degrees of doctor of science and doctor of laws and the medal of the Societé Odontologique de Paris; is an officer l'Academie, and served as secretary general on the Fourth International Dental Congress. Dr. Kirk is also editor-in-chief of the *Dental Cosmos* and the author of numerous books.

Dr. Hyatt Promoted: Announcement is made of the appointment of Thaddeus P. Hyatt, in charge of the dental clinic of the Metropolitan Life Insurance Company, New York City, to the position of assistant medical director of the company.

Resolution on Use of Roentgen Ray in Diagnosis: The following resolution presented before the Pathodontia Section of the First District Dental Society of New York, December 17, was unanimously adopted:

WHEREAS, the officers and members of the Pathodontia Section of the First District Dental Society recognize the importance of the use of the x-ray as an aid in diagnosis and during the process of treatment of pulpless teeth, and

WHEREAS, certain practitioners ignore this procedure, and

WHEREAS, such practice is considered contrary to the best interests of the patient; therefore, be it

Resolved, that such procedure will be considered questionable practice in this branch of dentistry, and be it further

Resolved, that this resolution be entered in the minutes of this Section and a copy be forwarded to the professional journals for publication and also inserted in an early issue of the *First District Dental Society Bulletin.*

New Dental School in Port-Au-Prince: The new dental school recently opened in Port-au-Prince, Haiti, is a part of the National School of Medicine and Pharmacy. The building is of modern architecture and the students are assured every advantage through a carefully arranged curriculum, practical opportunities for clinical work on public school children and the facilties of a splendid library. Equipment is of the best and is most modern. Besides the operating rooms, there are chemical, histologic and mechanical laboratories. Much attention is to be given mouth hygiene for school children and the people in general. Jules Thebaud is the head of the dental department, and Marcel

Dartiguenave and S. E. A. Daniel are among those on the staff.

Child Health Day: May Day, 1929, will be proclaimed by the President of the United States as Child Health Day. In recent years, the President has voluntarily given out a message of interest and good will for the observance of May Day as Child Health Day. In May, 1928, the Congress of the United States passed in both houses a resolution establishing May 1 as Child Health Day forever and so to be proclaimed by the President annually. In his capacity as president of the American Child Health Association, Herbert Hoover said: "Everywhere this day let thoughtful people renew their efforts to assure to every child the complete birthright of a sound mind in a sound body." An especial effort is to be made this coming May Day to foster in the child the "joy in pure recreation, the spirit of play."

Ethics and Signs: The present high standing of the dental profession is recognized not only by its associated professions, but by the social and economic worlds as well. This recognition has come about not through modern dental education alone. The high-mindedness of the individual dental practitioner and his pride in his profession's accomplishments are also responsible for the present high standing of dentistry. The Chicago Dental Society is favorably known throughout the dental world for its progressiveness. This reputation has been earned by the unselfish service of the individual members to the ideals of the Society. One of these ideals is the strict observance of the Code of Ethics. Within this great Society, there still remain a few scattered examples of unfairness which are unjust and which show a decidedly poor sportsmanship. We refer to those members displaying unethical advertising signs calling attention to themselves by such signs as "Gas," "X-Ray," "Extraction," etc. These are relics of the past, when dental ideals were in their infancy, and are positive violations of the Code of Ethics. Such signs have only imaginary value. The Chicago Dental Society, as well as the American Dental Association of which it is a component, does not countenance them. No man had been admitted to membership in recent years who displayed signs of this type. Therefore, out of justice and fair play they must disappear from every member's premises. The effort to induce members to remove all such advertising is meeting with decided success; and the fact that the dental society is officially opposed to them should induce those few members who still retain such signs to comply with the Code of Ethics and take them down at once. Failure to do this imperils a member's standing and opens the way to a charge of a violation of the Code, which sooner or later will be discovered and reported. This should be avoided, for a man's standing in his profession comprises one of his dearest assets. All members having such signs will please remove them at once. Signed: Board of Directors of the Chicago Dental Society; Board of Censors of the Chicago Dental Society.—*Bull. Chicago Dent. Soc.*

Conference of State Society Officers: The annual conference of state society officers was held in the Office of the American Dental Association, January 13, with an excellent attendance. After the roll call of states, the conference was addressed by the President of the Association, Percy R. Howe, on "Unity of State Societies and the American Dental Association." Other essayists participating were: C. Williard Camalier, Washington, D. C.; F. R. Adams, New York City; Homer B. Robison, Hutchinson, Kan.; Charles M. Alderson, Los Angeles, Calif.; Thomas M. McDonald, Rochester, N. Y.; G. A. Mitchell, Atlanta, Ga.; W. R. Meeker, Peru, Ind.; R. G. Keyworth, St. Paul, Minn.; and J. D. Jordan, Little Rock, Ark. Luncheon was served those attending, at the Stevens Hotel, where a banquet was also served at 7 p. m., followed by a round table conference.

Deaths

Dunn, William H., Chicago, Ill.; Chicago College of Dental Surgery, Dental Department of Loyola University, 1896; died, February 6, in Los Angeles; aged 62.

Potter, William H., Brookline, Mass.; Harvard University Dental School, 1885; died, July 27, 1928; aged 72. Dr. Potter was given the degree of m ster of arts by his alma mater in 1927 in recognition of nearly forty years of teaching and administrative work in the dental school, for his work in caring for the Allied wounded in France in 1914-1915 and for his service with the A. E. F. in France in 1917-1919. He was made a chevalier of the Legion of Honor for his services to the French republic prior to the entry of the United States into the World War.

Sims, W. T., Hillsboro, Texas; died, December 24; aged 54.

Dickinson, Edwin B., Amherst, Mass.; University of Pennsylvania, Evans Dental Institute, 1885; died suddenly, November 13, at the home of his son in Springfield; aged 65.

ANNOUNCEMENTS

CALENDAR OF MEETINGS*

NATIONAL SOCIETIES

American Dental Association, Washington, D. C., Oct. 7-11, 1929.

American Dental Assistants Association, Washington, D. C., Oct. 7-10, 1929.

American Society of Orthodontists, Estes Park, Colo., July 15-19, 1929.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June inclusive.

March (1929)

Louisiana, at Alexandria (14-16)
Minnesota, at St. Paul (6-8)
Montana, at Butte (28-30).

April (1929)

Alabama, at Birmingham (16-18).
Connecticut, at Waterbury (April 30-May 2).
Kansas, at Wichita (April 29-May 2).
Kentucky, at Louisville (9-11).
Mississippi, at Jackson (22-24).
New Jersey, at Asbury Park (10-12).
Oklahoma, at Oklahoma City (22-25).
Texas, at Beaumont (16-19).
Virginia, at Danville (April 30-May 2).

May (1929)

Arkansas, at Little Rock (20-22).
Illinois, at Springfield (14-16).
Indiana, at Indianapolis (20-22).
Iowa, at Cedar Rapids (7-9).
Maryland, at Baltimore (6-8).
Massachusetts, at Boston (6-10).
Missouri, at St. Joseph (12-14).
Nebraska, at Omaha (20-23).
New York, at Rochester (15-17).
North Dakota, at Grand Forks (14-16).
Pennsylvania, at Scranton (14-16).
Southern California, at Los Angeles (6-7).
Vermont, at Burlington (22-24).
West Virginia, at White Sulphur Springs (27-29).

June (1929)

Colorado, at Colorado Springs (17-19).
Georgia, at Atlanta (12-14).
Maine, at South Poland (20-22).
Michigan, at Detroit (18-20).
Nevada, at Reno (1).

July (1929)

California, at San Francisco (8-12).
Oregon, at San Francisco (8-12).
South Dakota, at Rapid City (1-2).
Utah, at San Francisco (8-12).
Washington, at San Francisco (8-12).
Wisconsin, at Milwaukee (9-11).

American Dental Society of Europe, London, England, July 29, 1929.

Dental Congress of Latin America, Rio de Janeiro, Brazil, July 14-21, 1929.

New York Society of Orthodontists, New York City, March 13, 1929.

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Arizona, at Flagstaff, beginning July 29, 1929. Eugene McGuire, Secretary, 420 Security Bldg., Phoenix.

Indiana, at Indianapolis, June 17, 1929. J. M. Hale, Secretary-Treasurer, Mt. Vernon.

Kentucky, at Louisville, June 7-11, 1929. Robert L. Sprau, Secretary, 970 Baxter Ave., Louisville.

New Jersey, at Trenton, June 24-29, 1929. John C. Forsyth, Secretary, 148 West State St., Trenton.

DENTAL SOCIETY OF THE STATE OF NEW YORK PRELIMINARY PROGRAM

The Dental Society of the State of New York will hold its sixty-first annual meeting in Rochester, May 15-17. Literary exercises, exhibits, etc., will be held at the Columbus Building. E. G. Link, Cutler Building, Ro-

chester, is chairman of the exhibits committee. John T. McIntee, Cutler Building, Rochester, is chairman of the clinics committee. The executive council will convene for the transaction of the business of the society, Tuesday, May 14, at 3 p. m. The essayists are Frederick B. Noyes, Chicago, Ill.; Chalmers J. Lyons, Ann Arbor, Mich.; O. G. L. Lewis, Philadelphia, Pa.; P. G. Lowry, Detroit, Mich.; T. W. Maves, Cleveland, Ohio, and James K. Burgess, New York City. During the time of the meeting, sessions of the New York State Dental Hygienists Association and the Dental Assistants Association will be held. Headquarters will be at the Hotel Seneca and reservations should be made direct with the hotel management. For information with reference to the literary exercises, clinics, etc., apply to

A. P. BURKHART, *Secretary,*
57 East Genesee St.,
Auburn, N. Y.

ALUMNI SOCIETY OF PHILADELPHIA COLLEGE DENTAL DEPARTMENT OF TEMPLE UNIVERSITY

(Notice of change of meeting)

The annual meeting of the Alumni Society of the Philadelphia Dental College Dental Department of Temple University will be held Wednesday, April 17, instead of April 18, as previously arranged.

RAYMOND T. WYCKOFF, *Chairman,*
Publication and Journal

LOUISIANA STATE DENTAL SOCIETY

The next annual meeting of the Louisiana State Dental Society will be held at Alexandria, March 14-16.

B. J. LACOUR, *Secretary,*
Welsh

AMERICAN DENTAL ASSISTANTS ASSOCIATION

The fifth annual meeting of the American Dental Assistants Association will be held in Washington, D. C., October 7-10.

RUTH F. ROGERS, *General Secretary,*
Suite 803—223 W. Jackson Blvd.,
Chicago, Ill.

KANSAS STATE DENTAL ASSOCIATION

The next annual meeting of the Kansas State Dental Association will be held, April 29-May 2, 1929, at Wichita. Among the speakers will be Martin Dewey of New York City, C. J. Lyons, of the University of Michigan, Ann Arbor, Mich., and F. E. Roach, Chicago, Ill. Members of the American Dental Association from other states are cordially invited to attend the sessions of this meeting.

FRED A. RICHMOND, *Secretary,*
305 Federal Reserve Life Bldg.,
Kansas City, Kan.

OKLAHOMA STATE DENTAL SOCIETY

The next annual meeting of the Oklahoma State Dental Society will be held in Oklahoma City, April 22-25.

WILLIAM J. SCRANTON, *President,*
Oklahoma City

E. E. SANGER, *Secretary,*
Yukon

AMERICAN DENTAL SOCIETY OF EUROPE

The forty-eighth annual meeting of the American Dental Society of Europe will take place at Grosvenor House, in London, July 29, 1929.

SIDNEY MCCALLIN, *Secretary,*
75 Grosvenor St.
London, W. 1.

KENTUCKY STATE BOARD OF DENTAL EXAMINERS

The annual meeting and examination of the Kentucky State Board of Dental Examiners will be held, June 7-11, at Louisville.

ROBERT L. SPRAU, *Secretary,*
970 Baxter Ave.
Louisville

MASSACHUSETTS DENTAL HYGIENIST SOCIETY

The annual convention of the Massachusetts Dental Hygienist Society will be held at the Hotel Statler, Boston, May 8-9.

ESTHER B. RUSSELL, D. H.

GEORGIA DENTAL HYGIENIST ASSOCIATION

The Georgia Dental Hygienist Association will hold its second annual meeting, March 12, at the Henry Grady Hotel, Atlanta.

ADDIBEL FORRESTER, *Secretary,*
803 Atlanta National Bank Bldg.
Atlanta

REHWINKEL DENTAL SOCIETY

The Rehwinkel Dental Society (Athens, Clinton, Fayette, Gallia, Highland, Jackson, Meigs, Pickaway, Ross and Vinton counties) will hold its annual midwinter meeting at Chillicothe, Ohio, Saturday, March 23, 1929, in the Blue and Gold rooms of the new Highland Community Restaurant, all day and in the evening. The program of essays and clinics will be one of the most extensive ever offered by this society. The latest equipment and apparatus will be exhibited. All ethical dentists are cordially invited.

WILLIAM G. HAMM, *Secretary,*
Chillicothe, Ohio

NEW YORK SOCIETY OF ORTHODONTISTS

The annual meeting of the New York Society of Orthodontists will be held the morning and afternoon of Wednesday, March 13, at the Hotel Commodore, New York City. An exceptionally attractive program has been arranged by the executive committee and all ethical members of the medical and dental professions are invited. Sessions open promptly at 9:30. The usual luncheon will be served between the morning and afternoon sessions.

WILLIAM C. FISHER, *Secretary,*
501 Fifth Ave.,
New York City

ARIZONA BOARD OF DENTAL EXAMINERS

The next meeting of the Arizona Board of Dental Examiners will be held in Flagstaff, beginning July 29. For further information and application blank, address

EUGENE MCGUIRE, *Secretary,*
420 Security Bldg.
Phoenix

STATE BOARD OF REGISTRATION AND EXAMINATION IN DENTISTRY OF NEW JERSEY

The State Board of Registration and Examination in Dentistry of New Jersey will hold its regular examinations at Trenton, commencing June 24, and continuing for five days thereafter. The examination fee is $25; reexamination fee, $10. The practical tests required are: insertion of an approximal gold filling, with the approximating tooth in position; a compound approximal amalgam filling, and a silicate filling, the candidate to furnish his own patient; taking of impression, bite selection of teeth, articulation and trial denture, the candidate to furnish his own patient; practical examination in mouth diagnosis. Attention is invited to the following quotation from the dental law of New Jersey: "Applicant shall present to said Board a certificate from the Commissioner of Education of this State, showing that before entering a dental college he or she had obtained an academic education consisting of a four-year course of study in an approved high school or the equivalent thereof." In accordance with this law, the secretary will issue application blanks only upon presentation of the required certificate from the Commissioner of Education, State House, Trenton. Application must be filed, complete, ten days before the date of examinations (June 14, 1929). Address all communications for particulars to

JOHN C. FORSYTH, *Secretary,*
148 West State St.
Trenton

THE NEW JERSEY STATE DENTAL SOCIETY

The fifty-ninth annual meeting of the New Jersey State Dental Society will be held in the Berkeley-Carteret Hotel, Asbury Park, April 10-12. Detailed notices will be published in April. Members in good standing will be welcomed. For information, address: exhibits, H. J. Gibbins, 75 Roseville Ave., Newark; clinics, K. C. Pruden, 44 Church St., Paterson; general items, F. K. Heaselton, Secretary, 223 East Hanover St., Trenton.

INDIANA STATE BOARD OF DENTAL EXAMINERS

The Indiana Board of Dental Examiners will meet at 8 a. m., June 17, at the State

House, Indianapolis, in the House of Representatives Room, for the purpose of examining all applicants with proper credentials. All applications should be in the hands of the secretary one week before the board meeting. For applications, clinical requirements, and other information, address

J. M. HALE, *Secretary-Treasurer,*
Mt. Vernon

"KENTUCKY INVITES YOU HOME"

The sixtieth anniversary of the Kentucky State Dental Association will be celebrated with a big Home Coming meeting. Efforts are being made to communicate with all former Kentuckians and all graduates of the Dental Department of the University of Louisville (formerly Louisville College of Dentistry) to urge them to attend the meeting. Many men who have not been back "home" in years have expressed their intention of attending the meeting, to meet with former classmates and renew old friendships. A program of unusual interest pertaining to general and dental health has been prepared in which some of the leading men of the profession will participate.

The meeting will be held in Louisville, April 9-10-11, with headquarters at the Brown Hotel. All ethical dentists everywhere are cordially invited to attend this meeting and can feel assured that an old-fashioned Kentucky welcome awaits them.

J. H. Fullenwider, 662 Francis Building, Louisville, will be pleased to supply any information regarding the meeting.

MICHIGAN STATE DENTAL SOCIETY

The unique and unusual method of holding a dental meeting on board a chartered Steamship has been adopted this year by the Michigan State Dental Society for its annual meeting. The S.S. Noronic leaves Detroit, June 18, for a three day cruise to the "Soo," Lake Superior, returning via Mackinac Island, arriving Detroit June 21. A most interesting program of essays, lecture clinics and entertainment has been arranged. A limited number of A.D.A. members from other states may be accommodated in the order their requests are received. Address at once The Cruise Committee, 1402 Stroh Building, Detroit, Michigan. The expense of the trip will be about the same as at a hotel.

WILLIAM R. DAVIS, *Secretary,*
Michigan Dept. of Health
Lansing

ST. LOUIS STUDY CLUB OF DENTISTRY CLINIC AND DINNER

The St. Louis Study Club of Dentistry, organized in 1919 for the purpose of teaching advanced dental knowledge to practising dentists, without charge, and in continuous operation since that time, has just completed its eleventh annual session. The close of the term will be marked by a clinic and dinner on Saturday, April 6, at the Chase Hotel, Kingshighway at Lindell Blvd. The clinic, which will start promptly at 3 o'clock, will consist of the following subjects: dental ceramics; fixed bridgework; dental roentgenology; rizadontia; conduction and local anesthesia; operative dentistry; full dentures; anatomy and dissection of the head; tooth form and cavity preparation; dental economics, and oral diagnosis and diseases of the mouth. Following the clinic, a dinner will be given at 6:30 p. m. as a tribute to the instructors by the students. A cordial invitation is extended to all ethical members of the profession to attend this clinic and dinner. Bulletins, descriptive of the Study Club, may be had by addressing Frank C. Rodgers, 309 Wall Building, St. Louis.

CORRECTION

In the February issue, in an article on "Postoperative Considerations Regarding Extraction of Teeth," by Boyd S. Gardner, the last sentence in the second paragraph beginning on page 237 should read "The socket should not be entirely closed in every extraction; another point not definitely understood."

SAVE "OLD IRONSIDES"!

To the American People:

Here in the Navy Yard lies a wooden hulk. Time has furled her sails and shorn her of her masts. Her aged timbers nevermore will know the seas that once she ruled. For this is no common ship, no flotsam derelict, but the ship that was once a Navy. "Old Ironsides," they called her, the U.S. Frigate "Constitution."

There's magic in her very name, a name too good, a fame too great to end as just a rotting wreck. Never did her colors know defeat. Foremost of our fleet, she swept the Barbary pirates from the sea and made privateers respect our new-born flag. In 1812 this wonder ship defended the new republic, defeated all she met, and became mistress of the seas.

Now, after more than a hundred and thirty years of service, in the shadow of Bunker Hill, near the yard that gave her birth, "Old Ironsides" rests in the dock she christened. She awaits repairs to make her sound, remodeled from truck to keel, exactly as she was in her days of greatest glory.

Already much material has been secured but she needs more. No less than 1,600 tons of live oak have come from Florida to brace a deck where heroes made our history. There is no state in our union that cannot furnish some important item to aid in the reconstruction. White oak from West Virginia, base of trees from Maryland, Douglas fir from Oregon, wrought iron from Pennsylvania, hemp from Kentucky, canvas from Georgia, etc., and not least the labor of veteran craftsmen from the ports of Maine who are making a faithful restoration of the old designs.

This is your chance to join the Navy in this great work. The legend of her fame is our Navy's greatest heritage. The children of our schools have given the fund a splendid start, $154,666. All told, contributions have reached a present total of $617,000. In order that the work may continue, $190,000 more is required immediately. No act of Congress, no Federal appropriation, assures her preservation.

When finished, she will visit all our ports and harbors, a floating museum of patriotic relics that will vividly teach to all who see her the history of the heroic struggle that made our country great.

Send your check, please, for any amount you care. A souvenir of "Old Ironsides" will acknowledge your contribution.

Yours sincerely,

PHILIP ANDREWS, *Chairman,*
Rear Admiral, U. S. Navy
National Save "Old Ironsides" Committee

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1929

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